THE HEATING AND VENTILATING MAGAZINE

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Vacuum Cleaning

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2—THE CARPET RENOVATOR.

In undertaking the comparison of a number of different makes of any appliance, in order to determine the good and bad points in each, where the apparatus is composed of a number of separate and distinct parts, each having its proper function, which they must perform in order to make the whole apparatus effective, as in a vacuum cleaning system, it becomes necessary to isolate temporarily each part and consider its action, first, as a unit working under the most favorable con-

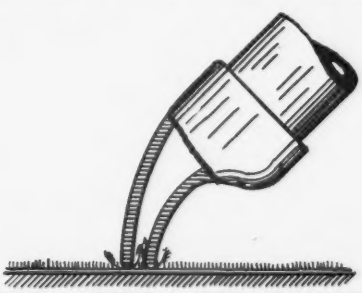


FIG. 1—TYPE A, THE STRAIGHT VACUUM TOOL.

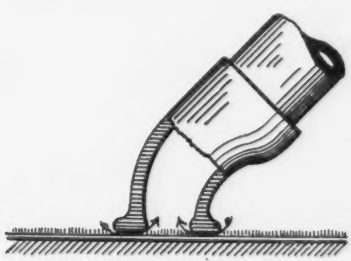


FIG. 2—TYPE B, WITH WIDE SLOT AND WIDE BEARING SURFACE.

ditions, and, second, as a component part of the whole apparatus in order to determine where the weak points in any system occur and what modifications are necessary in the various parts of the apparatus to make some vital part of the whole more effective. It is further necessary to determine

what are the vital parts of the system in order that the other parts may be accommodated to the effective action of this vital part.

FOUR IMPORTANT PARTS OF VACUUM CLEANING SYSTEM.

In analyzing a vacuum cleaning system it naturally divides itself into four parts, viz.: the cleaning tool or renovator, the air-conveying system or hose and pipe lines, the separators or other means of disposal of the material picked up, and the vacuum producer.

The author considers that the renovator is the most important part of the system and that portion which should be properly designed and that the other portions of the system should be made of such proportions and with such physical characteristics as will produce the proper conditions at the renovator to permit it to perform its functions in the most effective manner.

As the vacuum cleaning system must be capable of cleaning surfaces of a widely variable character many forms of renovators are necessary. Of the various surfaces cleaned the author considers that carpets and rugs comprise the most important, as well as the most difficult to clean effectively so that the carpet renovator will be considered as first in importance.

THE STRAIGHT VACUUM TOOL.

Various forms of carpet renovators have been and are in use by manufacturers of vacuum cleaning systems. The first form of carpet renovator, that used by Mr. Kenney and still in use by many manufacturers, has a cleaning slot about 3-16 in. wide and 12 ins. long, with rather sharp edges in contact with the carpet. This has been christened the "straight vacuum tool" and is of the form shown in Fig. 1 (Type A). This form of renovator is easily operated over any carpet, even when considerable vacuum exists within the renovator itself, and it met with favor when used with the piston type of vacuum pump without vacuum control, as used with the earlier systems. However, when a very high degree of vacuum occurs within this renovator it has a tendency to pull the nap from the pile of the carpet cleaned.

Soon after the introduction of this form of renovator the users of same, particularly in San Francisco, complained that while this renovator effectively removed dust from carpets that was practically all that it would remove and preliminary

or subsequent cleaning to remove matches and other small articles by other means was necessary.

To overcome this difficulty a wider slot of the same form was tried with the result that with a high degree of vacuum within the renovator it stuck to the carpet, rendering its operation difficult and at the same time doing great damage to carpets. Its use with piston pumps was soon abandoned.

Next, a renovator with a wide cleaning slot and wider bearing surface on the carpet, of the general form shown in Fig. 2 (Type B), was tried. This renovator was not as destructive to the carpets as the second form. However, it still

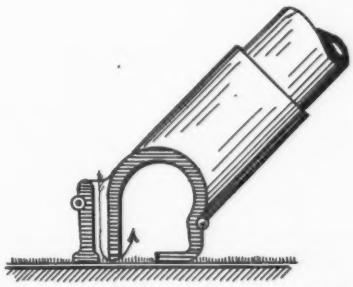


FIG. 3—TYPE C, WITH AUXILIARY SLOT, OPEN TO ATMOSPHERE.

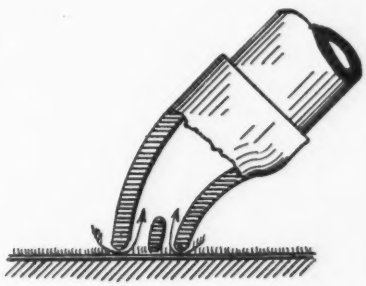


FIG. 4—TYPE D, WITH TWO CLEANING SLOTS.

pushed hard, and also would not do effective cleaning, owing to the greater area of surface in contact with the carpet, preventing the entrance of sufficient air.

RENOVATOR WITH AUXILIARY SLOT OPEN TO ATMOSPHERE.

The renovator introduced by the Sanitary Devices Manufacturing Company differed widely from the former types in that it was provided with an auxiliary slot, open to the atmosphere through the top of the renovator, which communicated with the slot open to the vacuum by a space of 1/32-in. under the partition separating the slots. The cleaning slot was made 5/16-in. wide and the face of the renovator in contact with the carpet was made very wide as shown in Fig. 3 (Type C).

This auxiliary slot or vacuum breaker permitted air to enter the cleaning slot even when the renovator was placed on a surface plate, and, owing to this feature, a high degree of vacuum never existed within the renovator. It was always easy to operate and did not damage the the carpet. Owing to the wide slot, articles of considerable size could be picked up, and, as there was always an abundance of air passing through

the auxiliary slot, quite effective cleaning could always be done.

The vacuum producer, control apparatus and the proportions of the hose and piping used at that time made the degree of vacuum in the renovator a function of the quantity of air passing, with wide limits of variation under exxisting conditions, and this form of renovator is practically the only form which will do effective cleaning, including the picking up of litter, without undue wear on carpets, when used with a system having the above-stated characteristics.

The disadvantages of this form of renovator are that the wide surface in contact with the carpet prevents the entrance of any air under the renovator and, when operated on a carpet having a glue-sized back, no air comes through the carpet; therefore, all air must enter under the partition between the auxiliary and the vacuum slots. Under these conditions only one side of the vacuum slot is effective for cleaning.

When operated on an ingrain or other loose-fabric carpet, much air enters through the carpet as well as through the inrush slot, making this renovator, when operating under these conditions, use an unnecessary amount of air. The inrush slot also frequently becomes clogged with lint and dust and is rarely cleaned out. The author has found the majority of this

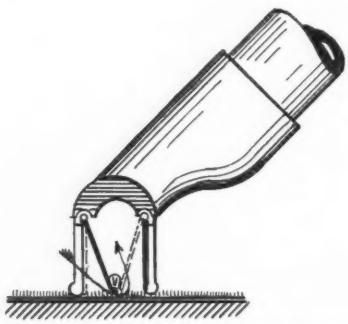


FIG. 5—TYPE E, WITH INRUSH SLOT ON EACH SIDE OF VACUUM SLOT.

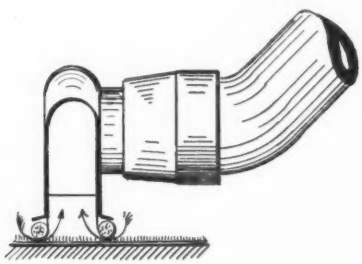


FIG. 6—TYPE F, AN EXAGGERATED FORM OF TYPE B.

type of renovator that has been in service for any length of time to be in this condition, and when this occurs the renovator becomes an exaggerated example of Type B (Fig. 2), and is practically useless as a dust remover.

RENOVATOR WITH TWO CLEANING SLOTS.

Another form of renovator was introduced by the Blaisdell Machinery Company which contained two cleaning slots each

3/16-in. wide and 12-in. long, separated by a partition ¼-in. wide in contact with the surface of the carpet, as indicated in Fig. 4 (Type D). While this form of renovator has a greater area of cleaning slot than Type A, its individual cleaning slots are no wider; therefore, it cannot pick up anything larger than can be picked up by Renovator A. As no air can enter under the partition it can do no more effective work as a dust remover when operated on a carpet with a glue-sized back and its only advantage over a cleaner of Type A is that when operated on a loose fabric carpet more air can pass through the fabric into the cleaning slot, thus giving a greater variation in the quantity of air exhausted when operated on carpets of different texture, a condition which is undesirable when used with a system having characteristics formerly described.

RENOVATOR WITH INRUSH SLOTS ON EACH SIDE.

Another form of renovator, introduced by Mr. Moorehead, is illustrated in Fig. 5 (Type E). This is a modification of Type A in that an inrush slot is provided on each side of the vacuum slot, these inrushes being formed by hinged members which form the sides of the cleaning slot. This cleaner has the advantage over Type C renovator that it can take air from either side, but in action it takes air from but one side at any time. Its inrush will not become entirely clogged, but its mechanically-moving parts in contact with the dust and lint picked up will easily become inoperative and are as like as not to become caught wide open when the air entering the cleaner will not come into intimate contact with the carpet. In that event, its cleaning efficiency will be greatly reduced. The author has not had an opportunity to make any compartive tests of this form of renovator.

The last type of carpet renovator to be successfully used is a Type A renovator with a cleaning slot either ½-in. wide and 12-ins. long or 15 ins. long, with a width at each end of ¼-in., widening to ¾-in. at the center (Fig. 6). This type of renovator is an exaggerated form of the second type of renovator tried by Mr. Kenney and its successful operation depends on its use with a system having a vacuum producer of such characteristics and a hose and pipe line of such proportions that practically a constant degree of vacuum is maintained within the renovator, regardless of the quantity of air passing through the renovaor. This type of renovator was first introduced successfully by Mr. Spencer, and is of the general form shown by sketch (Fig. 6).

About six years ago the author began a series of tests of carpet renovators to determine.

(1) The feasibility of using a carpet cleaning test to determine the merits of a vacuum cleaning system.

(2) To fix the requirements to be incorporated in a specification where acceptance of the system was dependent on a satisfactory cleaning test.

(3) To determine what requirements, rather than a cleaning test, would be necessary to obtain a first-class cleaning system.

The only test of which there was any record at this time was one made by the Massachusetts Institute of Technology of renovators of the type used by the Sanitary Devices Manufacturing Company and the Vacuum Cleaning Company, which showed the inrush type of renovator (Type C) to be the most efficient, but did not state whether the Kenney renovator was of Type A or Type B. However, the author is of the opinion that the renovator tested was of Type B.

TESTS WITH TYPE A RENOVATOR.

The first test, by the author, was made on a Wilton velvet rug of about 12 sq. yds. in area. The material spread on same was a mixture of flour and dirt from the separators, 3 lbs. of which were spread on the rug and rubbed in with sticks of wood as well as possible and the rug cleaned for 3 minutes, using a Type A renovator attached to the separator with 50 ft. of 1-in. diameter hose. The results were as follows:

Vacuum at separator, Inches mercury.	Per cent. dirt removed.
5	95
10	98
15	98

Comparison of these results with the results obtained at the Institute of Technology, where but 65% of the sand used was removed from the carpet with Type A renovator in 6 minutes, indicated that the usual method of demonstration of a cleaning system by picking up flour from the surface of a carpet was not the proper test to determine the ability of a cleaner to remove dust from a dirty carpet. This led to the question whether the conditions of the test at the Institute of Technology were not more difficult to meet than the cleaning of a dirty carpet.

In the February issue Mr. Cooley will continue his discussion of vacuum cleaning tools and appliances.

The Effect of Humidity, Temperature and Barometric Pressure on the Blood-Pressure

By B. RAYMOND HOOBLER, A.M., M.D.

The various meteoric conditions which enter into problems of ventilation have been studied for some time past. These conditions are becoming more and more recognized as important etiological agents in the maintenance of health and the production of disease and are receiving more attention, both from climatologists and from experts in ventilation. Their importance, therefore, warrants careful investigation on the part of the medical profession.

From an engineer's point of view the standard of ventilation is expressed thus "the perfectness of the ventilation in a room is ordinarily determined by the amount of carbon dioxide gas."

Other writers point out the discomforts of poor ventilation as being excessive temperature, unpleasant odors, lack of moisture, too much moisture and too little air movement.

In a recent article in THE HEATING AND VENTILATING MAGAZINE (May and June 1912) W. Gilman Thompson, M. D., attacks the present methods used by the average engineer for determining the fitness of air for breathing. In lieu of their method, which he calls the physical method, he proposes a physiological method. Diametrically opposed are these two methods, for one deals with man and the other with his environment.

It is evident that the engineers in times past have considered the problem as being one of a "Room" and not a "Man" to be ventilated. The purpose of this paper is to present certain facts bearing upon the effects of humidity, temperature and barometric pressure on the blood pressures of men.

From an unsuspected source has been connected a mass of information which has a direct bearing on ventilation problems. This is by means of the calorimeter. The classical standard for what seemed good ventilation has been overturned by the data obtained through observations made by means of the Atwater and Benedict calorimeter in this country, and through a similar apparatus in the hands of Flugge and his pupils of the Breslau laboratory. It was shown conclusively by the researches of these investigators that carbon dioxide gas was not as poisonous as commonly believed, since individuals have remained in sealed chambers in which the per cent. of this gas was as much as 161 times as great as in normal air, with apparently no injurious effects.

Paul carried out an experiment on himself. He remained 4½ hours in a sealed chamber. Data obtained was as follows:

Temperature.		Relative Humidity.		Carbon Dioxide Parts per 1,000.	
Beginning,	End,	Beginning,	End,	Beginning,	End
14° C.	17.2° C.	49%	61%	0.5	16.

Most of the discomforts of poor ventilation have to do with air in its effect on the body other than as a means of respiratory exchange. For example, in the matter of drafts: from the standpoint of respiratory exchange, we are benefited by the fresh air brought to us by such air currents, but the effect of these same air currents on the vasomotor apparatus is quite another matter. Again, air heavily laden with moisture may be well-breathed and feel soothing to the mucous membrane, but such air already saturated with moisture will take up no more and the whole body becomes bathed in perspiration and the vasomotor and heat centers are worked overtime to accommodate the body to such an environment.

EFFECT OF AIR NOT BREATHED AN IMPORTANT FACTOR.

It will be seen, therefore, that air fit to breathe in, is but one of the requirements, for it must be fit to live in, as well. In other words, we are as much affected by the air surrounding us which we *do not* breathe as by the air we actually *do* breathe. Taking this view-

point we must enquire in what ways the air which surrounds us but which we may never breathe, acts on the body.

1. The most important action is by virtue of the ability of the air to absorb moisture. Evans states, "The body is constantly giving off moisture to the air. It is estimated that the amount which a healthy person gives off by the skin and lungs together, is about 550 grains per hour, which is enough to raise the relative humidity of the vapor in 380 cu. ft. at 60° F. from 75% to complete saturation."

2. The body also is constantly giving off heat. It is estimated that 200 B. T. U. are given off in a day for each child and about 500 B. T. U. for an adult. The relationship of the heat and moisture in the air is a very close one. H. M. Smith, quoting Warren S. Johnson, says, "It is a curious fact that it is only through the moisture in the air that it retains heat. Heat naturally radiates from all bodies that are warmer than their surroundings. If the air has little or no moisture in it, the radiated heat goes right through it without warming it. But if it is moist, it stops the radiated heat and the moisture is heated. If it were not for the moisture in the air, it would be too cold to live in."

3. Another factor in the air which is constantly affecting the body is the atmospheric pressure. This pressure is constantly changing and the body is subjected (in the vicinity of New York) to a change in altitude of approximately 2500 ft. within the space of a few hours.

4. The vasomotor apparatus is constantly being played on by the atmospheric environment, one moment opening superficial capillaries, the next closing them in order to maintain circulatory equilibrium. And not only the superficial capillaries, but the large splanchnic area as well is at the mercy of environment through reflex action.

5. The body is constantly being stimulated by fresh air or depressed by superheated air. Certain cases, in which there is nervous instability, are greatly stimulated by the fresh open air. It is remarkable how many cases of St. Vitus dance which have been in the wards for months will quickly recover when sent to the country.

6. The body, if remaining at rest for a time, naturally becomes a center of vitiated air which needs to be removed (air envelope of Heymann). Therefore, the air in its function of motility, has an important bearing on the human mechanism in carrying away heat and moisture and in bringing fresh air to be again laden.

Each of these functions of the air should be studied in its relation to the human organism and their inter-relationship must as well be considered. The subject is complex. The following tabulation, however, sums up the main features, thus:

Functions of the air due to its	Functions of the air, their effect on man, as shown by the changes in
Moisture,	Blood pressure,
Temperature,	Pulse rate,
Movement,	Respiration rate,
Atmospheric pressure,	Metabolism,
Stimulating or depressing effect,	Nervous phenomena.

All of the above have to do with the effect of air on the surface of the body and do not take into account the air in its function of respiratory exchange.

With many divergent views it seems advisable to attempt to elicit some data from the *individual* who is to be ventilated rather than to study the *room* which is being ventilated. No one single criterion can be relied upon, but all the data which can be obtained should be considered.

No system of ventilation can be counted perfect which

(1) causes the pulse to beat unusually fast or slows it unduly,

(2) causes rapid or increased respiration or unduly retards it,

(3) causes blood pressure to fall below the normal or so changes it as to be inimical to the welfare of the individual.

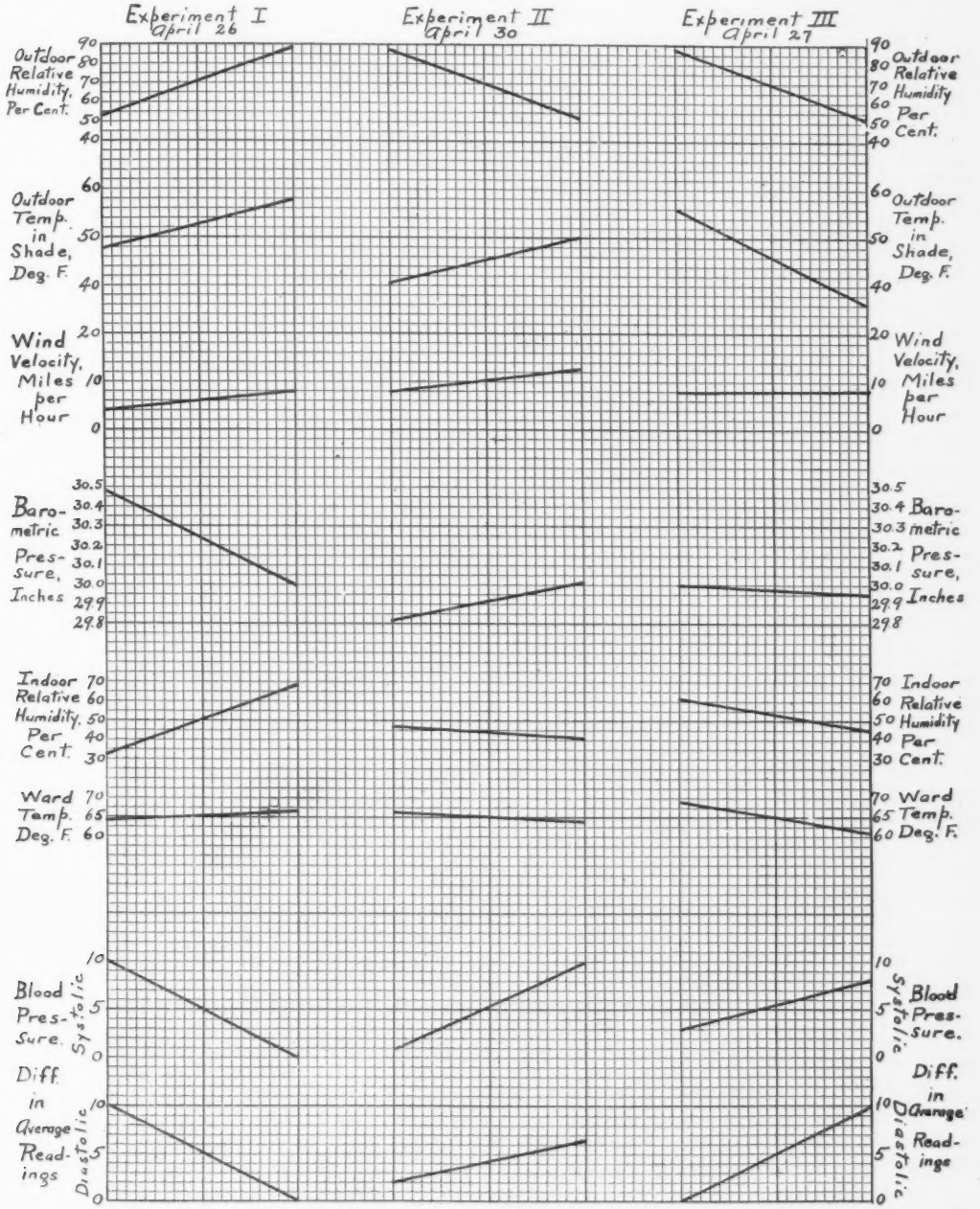
The ventilation variants in a hospital ward or school room are in the main humidity, temperature, air movement and barometric pressure. We shall try to point out that each of these by themselves may have an effect of good or ill upon the human organism.

DESCRIPTION OF EXPERIMENTS.

The data collected comprises an accurate reading of the temperature of the hospital wards and out-of-door temperature, relative humidity in wards and

out-of-doors, hourly barometric pressure recorded and furnished through the courtesy of the U. S. Weather Bureau. Coincident with these observations, a series of blood-pressure readings was taken. Only such patients as were confined to their beds and who had no increase in temperature were considered.

A group of about ten patients was examined and blood pressures recorded in each of three wards every day. The pressures were then added together and



RESULTS OF THREE DIFFERENT EXPERIMENTS FOR BLOOD PRESSURES UNDER VARYING CONDITIONS.

Exp. 1, showing marked fall of blood pressure when barometer was falling and humidity rising.

Exp. 2, showing marked rise in blood pressure simultaneous with a rise in barometer and a fall in humidity.

Exp. 3, showing rise in blood pressure coincident with a marked fall in humidity and temperature, barometer being about stationary.

an average for the ward for that day determined. The same patients were examined the following day and an average for each ward was again determined. It is these average pressures which the writer has used in compiling his data, since it is obvious that the average of a number of pressures would furnish a better basis for study than individual pressures. The relative humidity was determined by the use of the sling psychrometer and the tables of the U. S. Weather Bureau used in computation.

Charts showing three different experiments will present the principal findings deduced from the above series of observations.

Experiment I.

From the chart one will see that the following conditions were present: outdoor humidity rising; outdoor temperature rising; wind pressure rising; barometric pressure falling; indoor humidity rising; temperature of ward rising.

Under the above conditions there was a marked fall in the combined blood pressures of ten individuals who were subjected to the above variations. The factors which varied most were the barometric pressure and humidity and to these two factors may be assigned the cause of the fall in the blood pressure.

This is not merely an isolated experiment but the identical result occurred in each of three wards where observations were taken. The increasing humidity during this experiment was doubtless the most important factor. During the course of the experiments there were 17 occasions in which the relative humidity varied over 20% during 24 hours. In 77% of the observations made during such periods it was found that as humidity rose, blood pressure fell and as the humidity fell, blood pressure rose.

Experiment II.

The conditions are the reverse of Experiment I, except so far as outdoor temperature and wind pressure is concerned; that is, humidity outdoors and in ward is falling; barometric pressure rising and ward temperature falling. These conditions are favorable for a rise in blood-pressure and, as the experiment shows, the blood-pressure did rise.

Experiment III.

This experiment is diametrically opposite to Experiment I in every particular, except that there is but a slight fall in barometric pressure. There was about as great a fall in humidity in Experiment III as there was a rise in humidity in Experiment I. The element of temperature is more pronounced in this experiment than in either of the other two since there was a decided fall both out-of-doors and in wards. The controlling factors in Experiment III are a falling humidity and a falling temperature. These should produce a rise in blood pressure and it is seen that such a rise did take place. The effect of cold fresh air in pneumonia and tuberculosis is to cause a rise in the blood pressures. Charts showing results of such experiments were published in THE HEATING AND VENTILATING MAGAZINE for May, 1912.

FACTORS WHICH INFLUENCE BLOOD-PRESSURE.

The factors, then, which influence blood-pressure are barometric pressure, humidity and temperature. The first of these cannot be controlled in a hospital ward; the other two may be. Temperature is easily controlled. Attempts, however, have been made to control humidity by means of an elaborate system of forcing moist air into the wards. Humidity may be somewhat controlled in this manner, providing there be the greatest care observed in keeping all windows and doors of the wards closed. It is a very serious question then whether that which is gained by having more moist air is not lost through the failure of having fresh air brought in through the open-window method.

HUMIDITY TESTS IN BUILDINGS EQUIPPED WITH AIR WASHERS.

In order to determine whether, in a hospital institution equipped with a first-class humidifier, with all the latest improvements, the humidity could be kept under perfect control, a series of experiments were carried out. The plant was in charge of skilled engineers

and competent nurses were in the wards. A period of four days was chosen in which the humidifier should be kept constantly in operation during the 24 hours. The nurses were instructed to keep the windows and doors of wards closed, as far as was possible.

During this period the temperature in ward and out-of-doors was observed, also the relative humidity in ward and out-of-doors. After this period of four days the humidifier was shut off and the relative humidity of the wards controlled entirely by the open-window method. The engineer's data concerning the ventilation system together with the humidity observations are recorded for each day as follows:

January 24, engineer's data: "All inside coils on; temperature in duct, 60° F. open; fan, 134 R. P. M., ninth notch. Humidity full on, closing and opening every 2 min." Humidity observations: (average of six observations taken between 9 A. M. and 6 P. M. in ward), relative humidity, 51.2%; average of six observations taken out-of-doors; relative humidity, 59.5%.

January 25, engineer's data: "All inside voils on; temperature in duct, 59-61° F. open; fan, 134 R. P. M., ninth notch. Humidistat at medium, on and off every 2 min." Humidity observations: (average of five observations taken between 9 A. M. and 3 P. M. in ward) relative humidity, 33.4%; outside relative humidity, 56%.

January 26, engineers data: "All inside coils on; temperature in duct, 59-65° F., closed at 65°; fan, 134 R. P. M., ninth notch. Humidistat off." Humidity observations: (average of six observations taken between 9 A. M. and 9 A. M. in ward) relative humidity, 37%; average of six observations taken at same time out of doors; relative humidity, 72%.

January 27, engineer's data: "Inside coils all on; temperature in duct, 42° F.; fan, 134 R. P. M., ninth notch. Humidity, full on." Humidity observations. Average of five observations taken between 10 A. M. and 6 P. M. in wards) relative humidity 36.4%; average of five observations taken at same time outside: relative humidity, 78.4%.

The average for these four days in which the humidity apparatus was running gives inside humidity 40%, with temperature 68.5° F. Out-of-doors the average humidity was 66% and the temperature 21° F.

On the four succeeding days the humidity in the ward was controlled entirely by opening and closing windows. The humidity apparatus and fans were shut off. The average for the four following days was, indoor humidity, 41%; indoor temperature, 65.5° F. Outdoor humidity, 76%; outdoor temperature, 28°. F.

From the above observations it appears that by judicious use of the open-window method the indoor humidity may be kept at about the same per cent. as with the use of the humidistat. It no doubt required more fuel to keep the temperature of the wards at 65° by the open-window method.

The following summary may be presented:

1. The human body is affected by air which surrounds it, as well as by the air which is breathed.

2. Air conditions which most affect the circulatory system of the body are amount of moisture, degree of temperature and atmospheric pressure.

3. A marked increase in relative humidity tends to depress the circulatory system and to decrease the blood-pressure.

4. A marked increase in barometric pressure tends to increase blood-pressure.

5. A market decrease in temperature tends to increase the blood-pressure.

The Development of the Switch Damper

By William J. Baldwin.

The history and development of the switch damper in mechanical ventilating work, together with a description of methods for minimizing duct work in such installations were the outstanding features of a lecture delivered by William J. Baldwin, December 7, at the Brooklyn Institute of Arts and Sciences, under the auspices of the Engineering Department.

Mr. Baldwin opened his lecture by quoting briefly from the recent statements regarding the effect of vitiated air

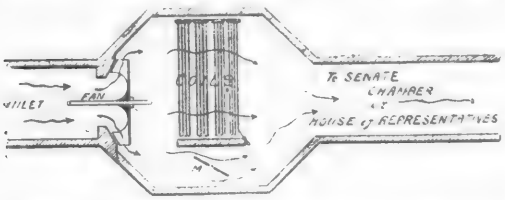


FIG. 1—FIRST APPLICATION OF SWITCH VALVE IN CAPITOL AT WASHINGTON, JOINT WORK OF JOSEPH NASON, ROBERT BRIGGS AND GEN. MEIGS. (1853).

Switch Valve Shown at M. Apparently no provision for shutting off air from coil.

on the human system made by Dr. Leonard Hill. He said the experts were now divided into three classes: (1) those who believed in no ventilation; (2) those who advocate natural ventilation; and (3) those who advocate systematic ventilation. Referring to Dr. Hill's experiments in which he kept a number of young men confined in an air-tight chamber where they suffered no ill effects so long as the air was kept in circulation, Mr. Baldwin declared that such tests were not conclusive as the results of such confinement could not be gauged in so brief a period. "Fans in closed rooms," he added, "will give cooling effects, but they do not change the quality of the air and sickness must follow. In France a favorite method of committing suicide has been to shut one's self up in a room with a charcoal fire. In a room containing 600 cu. ft. of air space, the burning of 1 lb. of charcoal will add 6 per cent of CO_2 to the air of the room. This addition of 6% lessens the amount of the original oxygen four parts for every six parts of the product. Thus, the condition is soon reached where there is relatively no oxygen, or insufficient oxygen to support life.

"There is no fault to be found with natural ventilation; any ventilation is better than no ventilation. Generally speaking, however, air cannot be admitted to a room in winter weather at the outside temperature, if admitted in large quantities, as in a school, and it should, therefore, be 'tempered.'

"A physician has characterized as 'canned air' that which has been warmed to 400° F. In the first place, it is practically impossible to heat air to that temperature, but admitting that it could be done, it seems to me that such heating would serve to sterilize it and make it all the purer. It is certain that all the germs it contained would be killed. As a matter of fact, however, steam at 5 or 6 lbs. pressure will not heat the air over 140°

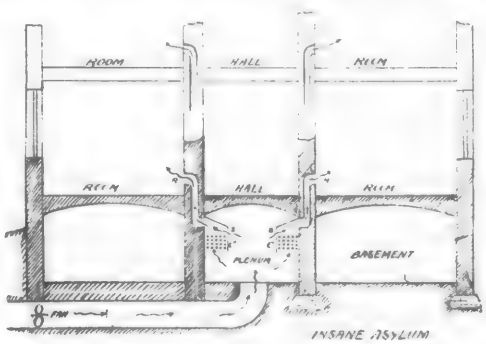


FIG. 2—LATER DEVELOPMENT OF SWITCH DAMPER BY JOSEPH NASON. (1850-1860).

By opening slide in radiator case, cool air passed over radiator. No means of shutting off air from coils.

or 150° F., and engineers do not ordinarily heat it even to that extent."

With this introduction, Mr. Baldwin stated that it was not his purpose to devote his lecture to a discussion of these points, but rather to how the various methods that had been used for securing

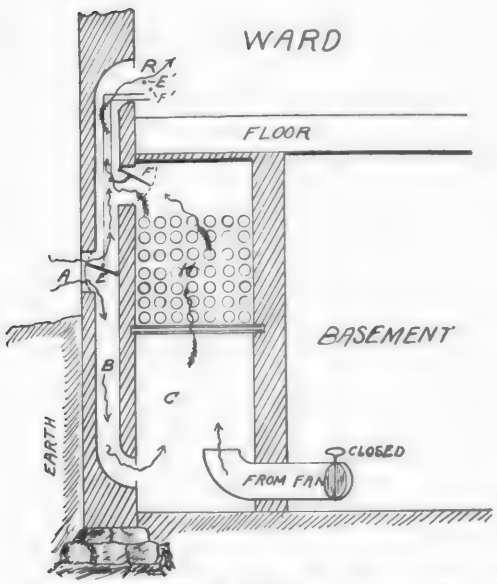


FIG. 3—SWITCH VALVE DESIGNED BY DR. JOHN S. BILLINGS, USED IN JOHNS HOPKINS HOSPITAL (1880).

Air could be taken direct from out-of-door, through coil from out-of-doors, or through coil from fan system in building.

systematic ventilation. This brought the speaker to the origin and use of the "switch damper," designed both for mixing the air and controlling the temperature. Incidentally, Mr. Baldwin showed how the switch damper can be utilized for regulating the humidity (as described on another page of this issue).

"The first switch damper of record," he said, "was used in the Capitol at Washington, and was designed by Gen. Meigs, U. S. A., to give mixed and tempered air through revolving disks under each desk. The ventilation of the Capitol was altered many times because people's feelings differ, the old requiring different treatment from the young, and a system that was satisfactory to one set of legislators would not be tolerated by a succeeding Congress. In Albany, it will be remembered, the same method of using disks or openings under the seats was once used. The apparatus was afterwards put in the ceiling, and the air forced downwards, but this was not satisfactory to all, as the 'down drafts' could not be tolerated by some. Being called in on this case, I reported in favor of returning to the 'up draft' method.

"The first switch damper was arranged so that the fan drew the air through the heating coils. This was later changed to force the air through and this arrangement is still in use in the Capitol, together with the original fan."

From this beginning the further development of the switch damper was shown by numerous lantern slides which are reproduced herewith. In the case of the Insane Asylum at Kalamazoo the speaker showed how the arrangement caused alternating hot and cold puffs of air while in the system designed for the Sloane Maternity Hospital, in New York, the use of double flues was pronounced highly satisfactory from a ventilating standpoint but was found impracticable for general adoption due usually to the lack of space for running such flues in the walls, while the building laws also interfered with this arrangement, unless the walls were made quite thick.

"The tendency of the times," continued the speaker, "seems to be to run into complicated apparatus. This is a back-

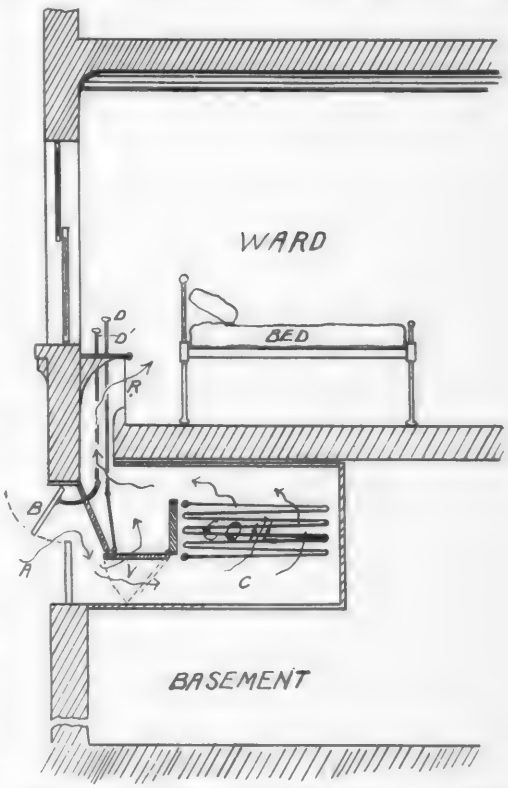


FIG. 4—SWITCH VALVE IN MASSACHUSETTS GENERAL HOSPITAL.

Upper part of basement windows used as air inlets.

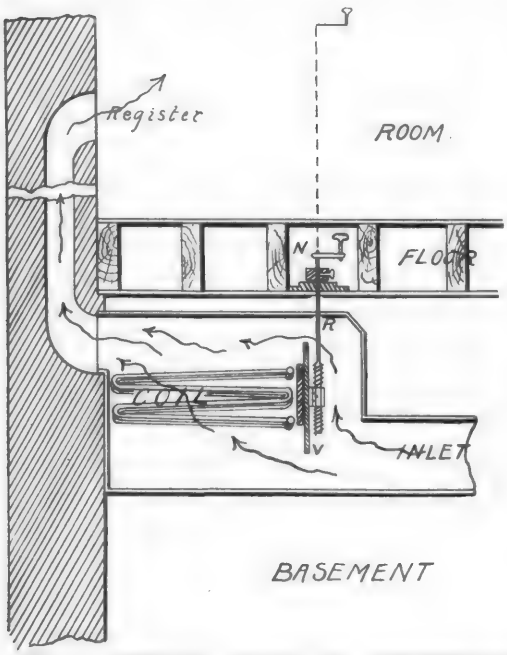


FIG. 5—SWITCH VALVE IN HOMESDALE PUBLIC SCHOOL.

Simple slide at end of heat coil, designed to move up or down.

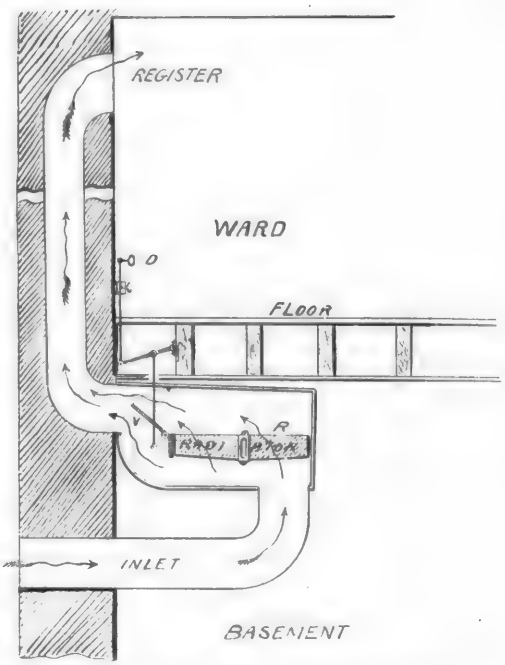


FIG. 6—SWITCH VALVE FOR BRIDGEPORT, CONN., SCHOOL (1885-1886).

ward movement and is largely responsible for the adverse criticism of the physiologists.

"When I go into a building and find a complication of pipes that I cannot decipher—after giving a life-time to the subject—I find an excuse for the harsh criticism of the doctors. 'Simplicity' should be our motto and not a network of 'warm air pipes,' 'cold air pipes' and 'vent pipes,' beautifully arranged from the standpoint of the sheet-metal worker; but an abomination from the sanitary point of view."

Mr. Baldwin concluded his lecture with a number of slides illustrating his own practice in arranging the heating and ventilating apparatus in separate corridors, at the sides of the basements, thus obviating to a large extent the use of sheet-iron ventilating ducts. He also showed instances of the reverse of this practice where the basements were practically honeycombed with air ducts and

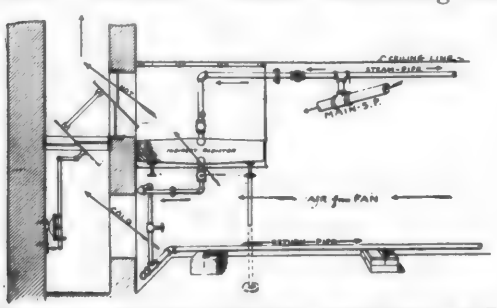


FIG. 7—SWITCH DAMPER DESIGNED FOR PATERSON, N. J., PUBLIC SCHOOL (1890).

Johnson System valve, automatically controlled.

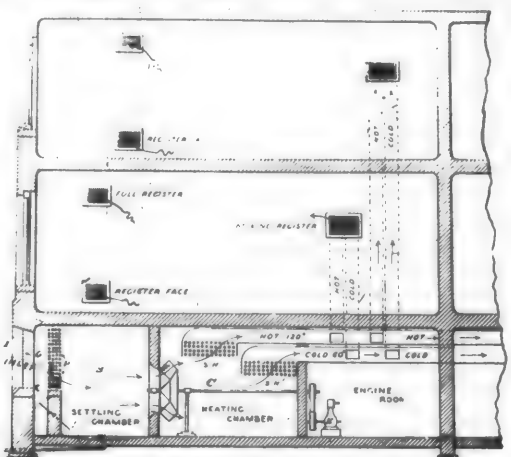


FIG. 8—SYSTEM DESIGNED BY WM. J. BALDWIN FOR VANDERBILT COLLEGE OF PHYSICIANS AND SURGEONS (1893).

One of first systems using hot and cold air flues carried to registers. Permitted individual control of temperature of incoming air at each register.

where in one case, that of the residence of Mr. Cornelius Vanderbilt, the ducts were so interwoven as to be almost impossible to clean. This, he said, was a most important feature for it was not unusual to find air ducts so filled with dust that they became ideal breeding places for vermin whose tracks were not only in the form of foot prints but often stomach prints showed, as the dust was so deep. The latter condition was observed in one of the New York City hospitals.

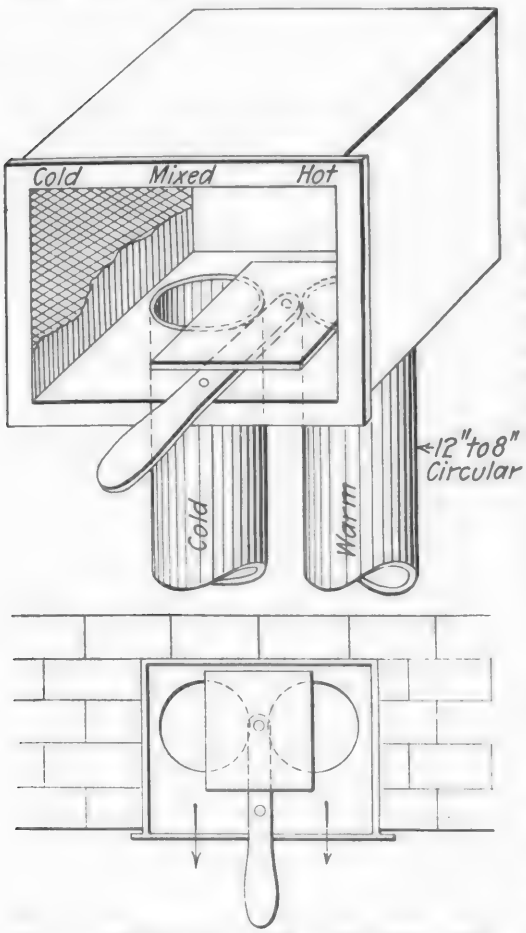


FIG. 9—SWITCH VALVE, COLLEGE PHYSICIANS AND SURGEONS, AND SLOANE MATERNITY HOSPITAL (1883).

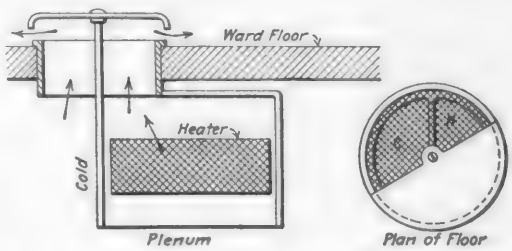


FIG. 10—A "MIXING MUSHROOM" HEAD, MOSES TAYLOR HOSPITAL, SCRANTON, PA. (1882).

Revolving cap under bed, half perforated, half solid, revolved by foot.

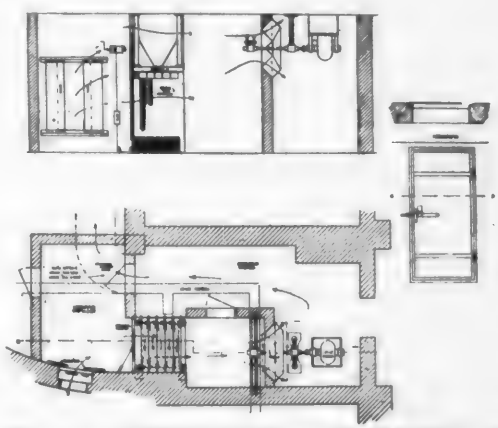


FIG. 11—VENTILATING APPARATUS IN NEW WAR COLLEGE AT WASHINGTON.

Shutter moves up or down admitting cold air at bottom and warm air at top, two currents being mixed by fan.

Fan Heating Systems for Foundries

By W. H. Carrier.

Various methods of arranging the air ducts in foundry systems of fan heating and ventilation were described by W. H. Carrier before the American Foundrymen's Association at its recent meeting in Buffalo. He enumerated the features governing the design and selection of the foundry heating and ventilation systems as follows:

1. Desirable temperature.
2. Even distribution of heat.
   (a) Prevention of cold drafts.
   (b) Economical applications of heat to avoid radiation of heat out-of-doors, and overheating of unoccupied space.
3. Ample ventilation when needed.
4. Rapid heating up of building in the morning.
5. Cost of installation.
6. Economy of operation and maintenance.

Taking up methods of heating other than by the fan system, he stated that, in general the temperature required in the foundry is from 5° to 10° lower than that which would be suitable for a machine shop—that is, the desirable temperature lies between 50 and 60° F.; 55% may be taken as a good general average.

The proper distribution of heat in the foundry is comparatively difficult. In general, the problem is that of a large open space, affording little opportunity for efficient placing of direct radiation. On account of the usual monitor type of building employed, there is relatively a great height. The hot air rises up into the lanterns and out through the ventilators if fans are not provided to keep it down near the floor. The heated column of air in the building acts like a chimney, drawing cold air from without at every opening. This inward leakage of cold air not only demands a great amount of heat, but makes a thorough distribution of heat at the floor line most essential to comfort and economy of operation. A slight plenum or outward leakage of warm air at these doors and openings, caused by the delivery and proper distribution of sufficient heated air into the buildings, is the only solution of this difficulty.

WHEN VENTILATION IS ESSENTIAL.

Ample ventilation is at times most necessary. The lantern type of building is best adapted to quick ventilation, since the ventilators simply have to be opened and the hotter and lighter gases and vapor will rise and pass out. The fact must be considered, however, that air is bound to come from somewhere to take the place of the air passing out through the ventilators. Cold air coming in through doors and openings will tend to cool off and condense the rising vapors to an even more serious and clouding extent. It is therefore essential that a system be installed which delivers fresh warmed air during the pouring period when ventilation is of prime importance.

Rapid heating up of the building in the morning means that the best efficiency from the men will be obtained over the entire working period. A system which is elastic and capable of rapid and accelerated results is to be favored.

Coke or gas fired "salamanders" are apparently the most economical form of heating, as all of the heat goes directly into the building. The atmosphere in a tightly closed building heated by this method, however, soon becomes intolerable, and if sufficient ventilation is provided to make conditions healthful, then the amount of heat required is greater than with other systems. The grade of fuel required is also considerably more expensive than other systems of heating, to say nothing of the care of a large number of separate fires scattered around the building.

WHEN TO INSTALL A STEAM HEATING SYSTEM.

In heating with direct radiation, steam is usually employed, although hot water systems, with forced circulation, have been successfully operated. Unless there are large amounts of hot

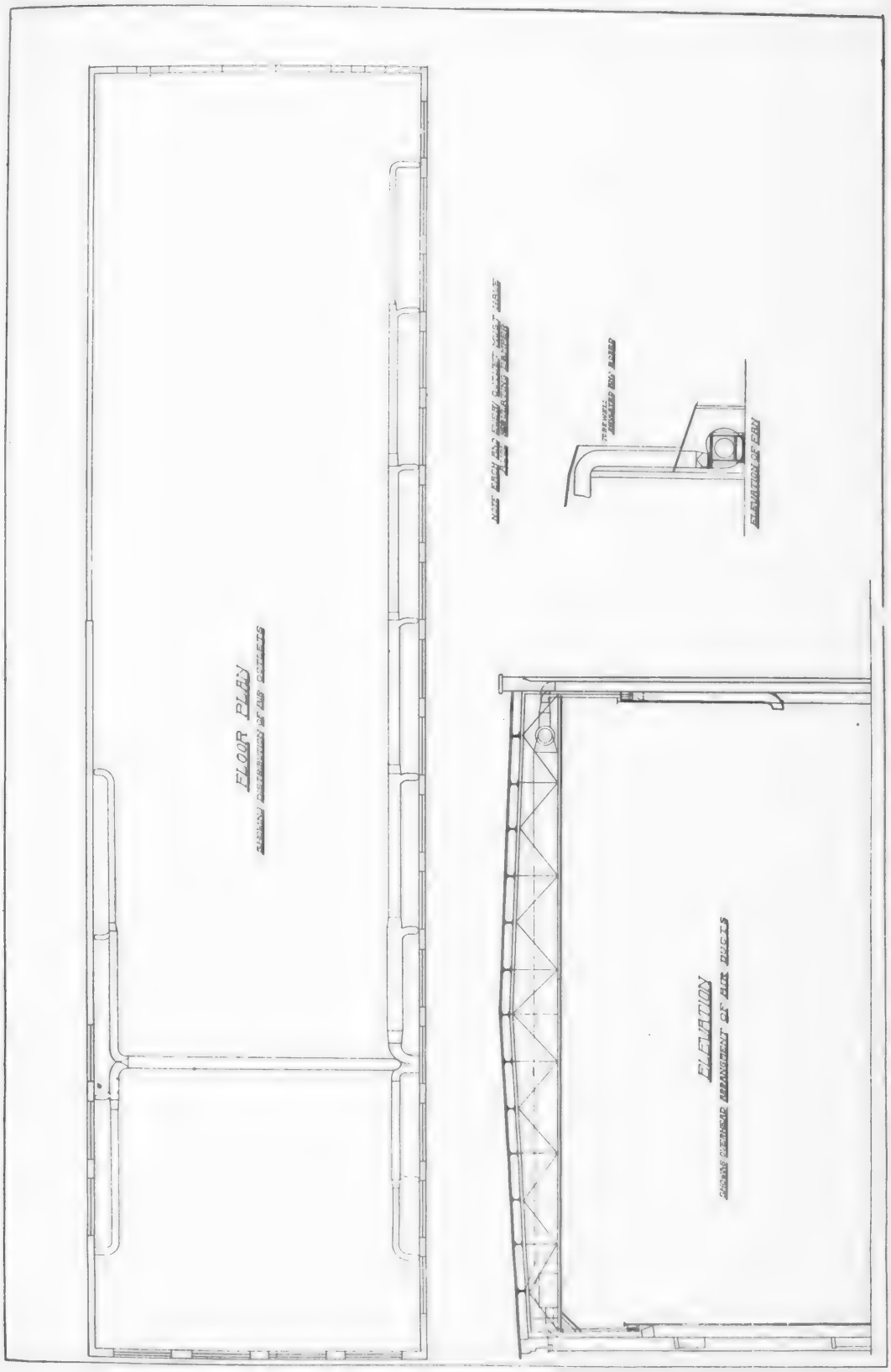


FIG. 1—HOT BLAST SYSTEM DESIGNED WITH DROP PIPES TO SECURE PROPER AIR DISTRIBUTION WHEN MAIN PIPING IS RUN NEAR ROOF.

water available, it is not an economical system to install, on account of the greatly increased amount of radiation which is required at the lower temperature. In steam heating, either the high pressure, the low pressure or the vacuum system of distribution is employed, the selection of the particular system depending on local conditions. Where high pressure steam is available and there is no exhaust steam, high pressure steam should be used because steam at 100 lbs. gives approximately 75% more heat per square foot of radiating surface than steam at 5 lbs. owing to its higher temperature. However, if there is no high pressure steam or exhaust steam available from the power plant, then an independent low pressure boiler should be installed to furnish steam at from 5 to 10 lbs. pressure. For low pressure work, cast-iron boilers may be used, and no boiler feed pumps are required. The boiler should be placed at a level so that the condensation will drain back by gravity. If this is impracticable, then a gravity system may be employed by using a centrifugal pump to raise the water level to that of the boiler. A vacuum system should always be used when exhaust steam from the power plant is available. In a vacuum system of distribution, the back pressure should not exceed 1 lb., as otherwise the power of the engines will be reduced and the steam consumption increased.

Probably the most satisfactory method of arranging the direct radiation is that of mitre type coils, placed along the outside walls between the windows, the main lengths of the pipe being vertical, to avoid accumulation of dust and to obstruct the side walls as little as

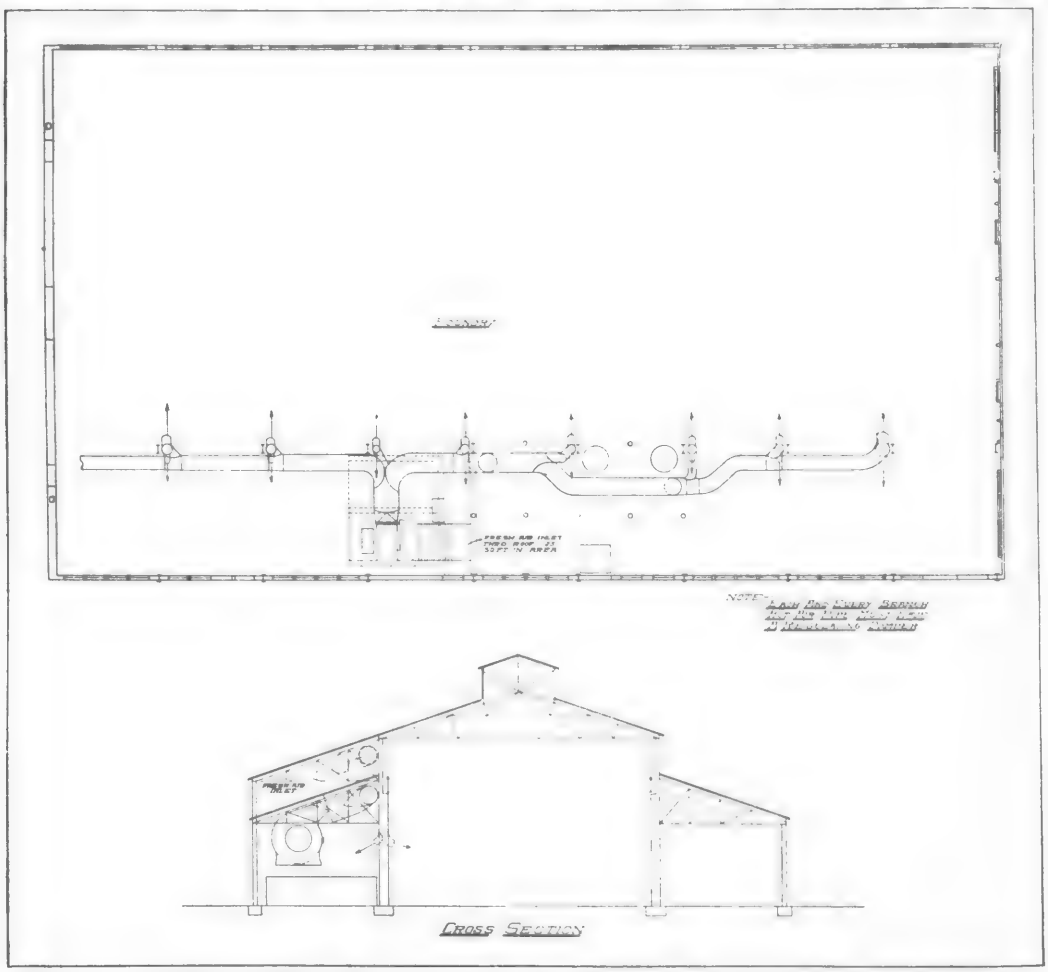


FIG. 2—DESIGN WITH ONE MAIN LINE OF PIPING FOR NARROW BUILDINGS.

possible. Several rows of pipe are also run along the side walls of the monitor roof just above the crane. This is to provide for the radiation of heat through the roof and skylights and to prevent cold down-drafts which would otherwise occur. Such distribution of radiation is not sufficient, but it is the only practicable method in this type of building.

ADVANTAGES OF FAN SYSTEM FOR FOUNDRY HEATING.

The best system for foundry heating and ventilation is undoubtedly the fan system, and it is particualrly adapted to the severe requirements of foundries and other buildings of this construction where there are large open spaces to be heated. The principal advantages of a fan system over direct radiation are:

1. The thorough diffusion and distribution of heat secured by discharging the air under pressure through suitable outlets, with sufficient velocity to carry the heat through the points where it is most needed, without causing perceptible drafts.

2. No heat is wasted as in direct radiation where a large portion is radiated directly through the walls out of doors, without affecting the temperature of the building. The fan system affords a means of supplying heat directly to the air itself.

3. No heat is wasted by heating unoccupied spaces, as along the roof and in the monitors. Tests of fan systems installed in foundries have in certain instances shown lower temperatures in the monitors than at 5 ft. above the floor line.

4. Fan systems heat up very much more rapidly in the morning when it is desirable in point of economy to bring the temperature up in as short time as possible.

5. It gives a rapid warm air charge which effectually removes smoke, steam and dust during pouring times, an effect which is possible only with a fan system. During such times as ventilation is required, the fresh and return air dampers would be adjusted to take all air from out-of-doors. During the balance of the time, however, the greater part of the air should be returned from the building to the apparatus, so that the heat required for ventilation is a minimum. Purchasers should always take the precaution to see that this feature is provided for in a proposed installation.

6. Fan systems cost less to install properly, since the apparatus is centrally located and it is not necessary to pipe the steam to all parts of the building as in direct radiation.

7. The cost of maintenance is less, since radiation along the walls is frequently damaged while in the centrally located fan apparatus it is thoroughly protected.

Just as in direct radiation, steam or hot water can be used in the fan system heater coils. The fact that the cool air is drawn over these coils by the fan, makes it possible, however, to obtain a great deal more heat from the same amount of heating surface. This cuts down the square feet of radiation about two-thirds.

Very often the fan is driven by a direct-connected steam engine, the exhaust steam from the engine being used in the heater coils. This is an exceedingly economical procedure, as practically every heat unit of the steam is utilized.

The main hot air ducts from the fan are usually of galvanized iron, carried overhead in the roof trusses. When these ducts are placed at a height not exceeding 20 ft., the air may be delivered directly into the building through short outlets. The design of these outlets is of particular importance to the success of the system. The velocity must be properly proportioned to the height, the size of the outlet and to the horizontal distance which the air is to be blown. The greater the distance and the height above the floor and the smaller the outlets, the higher the velocity must be to obtain the proper distribution. On the other hand, if the velocity is excessive for these conditions, objectionable drafts will be produced.

In certain cases as in Fig. 1, the main piping has to be placed too far above the floor to admit a good distribution of heat at the floor line with short outlets. In such cases it is usual to provide drop pipes from the main pipe at the columns or along the side walls. Where the drop pipes are placed at the columns,

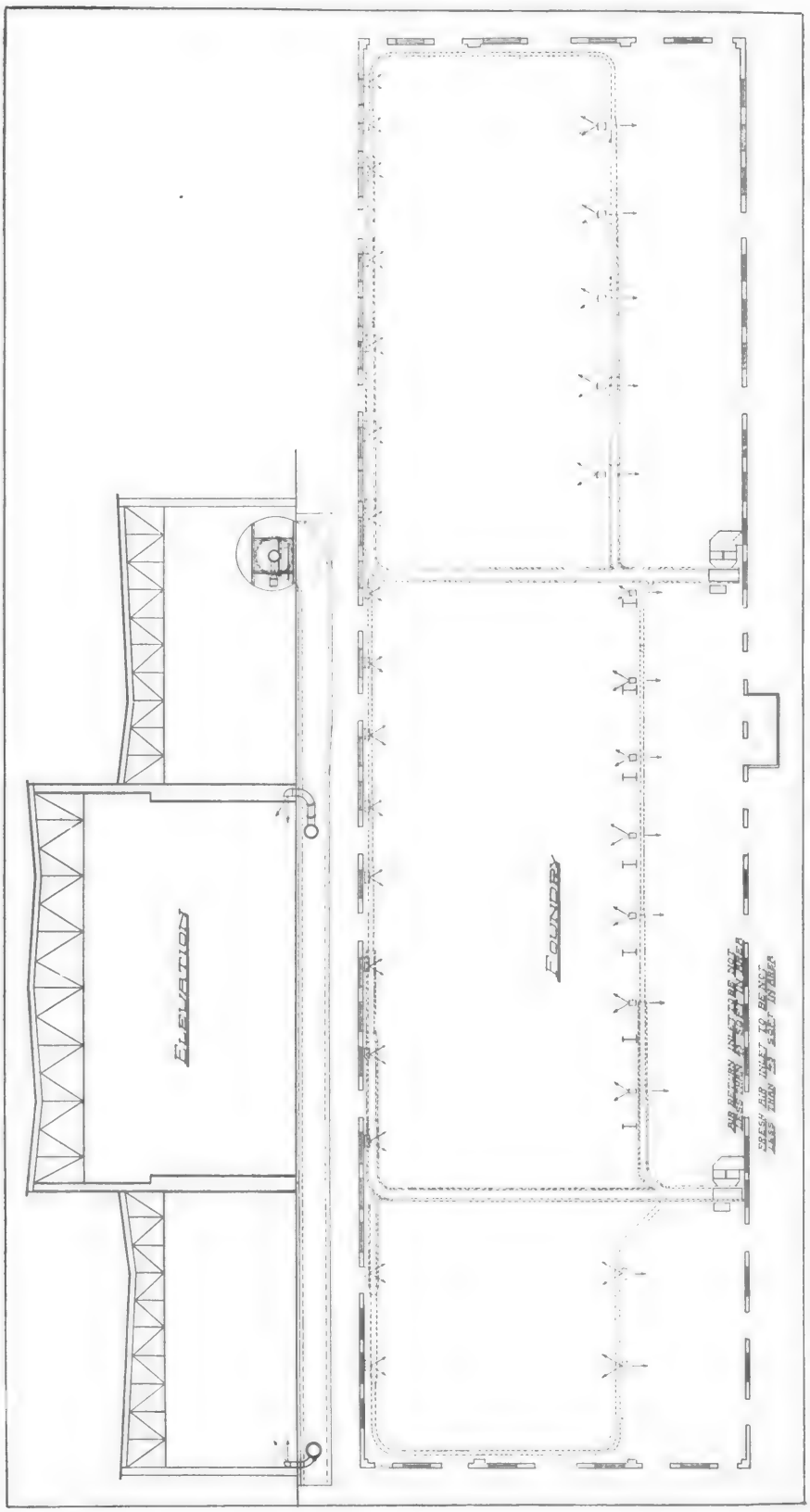


FIG. 3—SYSTEM WITH UNDERGROUND MAIN DUCTS AND GALVANIZED IRON VERTICAL RISERS IN WIDE BUILDING.

each is usually provided with two branches; one blowing towards the base of the windows at the side wall, the other blowing towards the center of the building, as in Fig. 1. Where the drop pipes are extended downward at the side walls it is usual to provide three outlets to each drop pipe, two blowing sidewise along the walls, and the third blowing outward toward the center of the building.

In wide buildings it is usual to run two lines of pipes along the columns on each side, while in narrower buildings it is possible to obtain an entirely satisfactory distribution of heat with one line of pipe, having outlets proportional to blow across the buildings to the further side, as in Fig. 2.

A very neat, though more expensive, system of distribution is with underground main ducts, and galvanized-iron vertical risers, arranged along the columns or side walls, or in some instances, as in the case of particularly wide buildings, at both places, (Fig. 3). The system of outlets in this case will be practically the same as where drop pipes are used.

Fig. 4 shows the arrangement employed in one of the large foundries in the country, that of the International Harvester Company, Springfield, Ohio. The building is very wide, as well as long, and distribution is made at four points across the building instead of one or two as is customary.

Fans may be either motor or engine driven. When plenty of exhaust steam is available for use in the heater coils the motor driven fan will be found most economical and satisfactory. It is also preferred by many on account of the great simplicity of operation and the little care and attention needed. On small fans it is good practice to directly connect the motor to the fan but on the larger apparatus the speed of operation is so low as to make it advisable to belt drive the fan, due to high cost of slow speed motors.

Engine driven fans are advisable when moderately high pressure steam is easily available. The steam can first be used to drive the fan and then the engine exhaust used in the heater coils. This procedure is exceedingly economical, since practically every heat unit in the steam is utilized. The power used to drive the fan is almost negligible, as the engine is really nothing more than a pressure reducing valve. The speed of operation with engine drive is also much more flexible, allowing a wide range of speed such as different weather conditions require.

COST OF INSTALLATION IN VARIOUS HEATING SYSTEMS.

Direct radiation and the fan system of heating cost practically the same to install; with the fan system, the power necessary to drive the fan, is additional and to the casual observer it would seem that the operating expense would be somewhat more than with direct radiation. The fact that the heat is distributed more efficiently with the fan system, cuts down the losses and necessary radiation materially, however, and the net operating expense of the two types of systems varies little in the long run.

Heating an Exposition Building With Artificial Gas

UNIQUE SYSTEM INSTALLED IN THE INDUSTRIAL EXPOSITION HALL, TOLEDO, O.

By A. H. GINDELL.

Toledo Railways and Light Company.

The heating with artificial gas of a large space, such as that occupied by the Industrial Exposition Hall, in Toledo, O., which comprises the train shed and first floor of the Terminal Railroad Company's pasenger station at Cherry and Seneca Streets, has seldom been attempted, for it is apparent that, under ordinary circumstances, the cost of such an installation would be prohibitive.

In this instance a system of gas heating was adopted after the heating plants of various public buildings of this type in several large cities were examined. The plan of heating, new to Toledo and

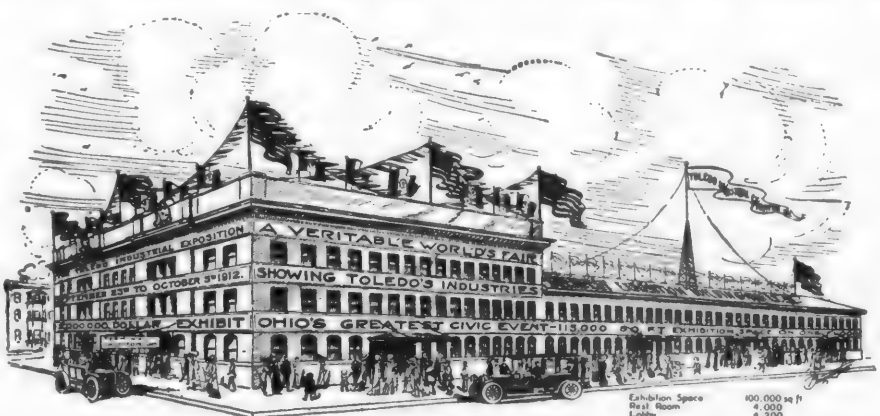
comparatively new of origin, is designed to provide ample heat for the building within the least possible time and, further, will be maintained at no expense whatever when not in use. Ample stove capacity is provided to take care of quick changes in temperature, so that the building will be intermittently heated. Separate control is provided for each unit, reducing the cost of operation materially. No licensed fireman or engineer is required, no coal is needed, nor repair bills incurred, while any section of the building may be heated as required without putting the whole heating system in operation, as with a steam or hot water plant.

The exposition hall is an entirely new brick building, the principal part of of which was formerly a train shed, 384 ft. long by 185 ft. wide. The front of the building contains offices and is heated by steam. When the plant was installed, no provision was made for extra boiler capacity to take care of the train shed, so that when the building was abandoned for railway purposes, and the train shed enclosed and remodeled, it was necessary to provide for a separate system of heating. This portion of the building alone has dimensions of 330 ft. by 185 ft. and is capable of seating, in its two sections, over 18,000 people.

At last year's automobile show, which was held there, a temporary steam plant was installed, with a complete equipment of radiators. In very cold weather this plant was inadequate and gas was then used to help out. This gave such good results that it was decided this year to equip the Exposition Hall with a complete gas heating system.

The plant is now complete and has cost nearly $1,800. As planned, the twin lobbies, first floor offices and hall, comprising 4,500,000 cu. ft. of space, are now heated by artificial gas. With this system, 104 gas stoves, of the type shown herewith, with overhead radiating ducts, are now installed.

There are two main risers, one located at the rear of the building and the other at the front section. Both are of 4-in. pipe. The running lines are partly 4-in., reduced to 3-in., with 2-in. branch lines, reduced to 1½ in. at certain points. The piping is connected together into a loop and all dead ends connected back again into the running lines, thereby equalizing the pressure at all points. All stove connections are ¾ in., reduced ⅜ in. at stove.



TOLEDO'S MAGNIFICENT EXPOSITION BUILDING
115,000 SQUARE FEET FLOOR SPACE ON ONE FLOOR.

The stoves used are all of similar design. They are known as Holding heaters, made by the Charpiot and Mills Mfg. Co., Toledo. The heaters consume between 22 cu. ft. and 35 cu. ft. of gas per hour.

Two large service pipes are installed and meter capacity provided up to 4,500 cu. ft. per hour, with the necessary headers, allowing for extra meters, if required. It is estimated that about 3,200 cu. ft. of gas per hour will be required for about 6 hours each day, while the building is in use, and about 1,200 cu. ft. per hour when it is unoccupied, gas being sold in Toledo on a sliding scale beginning at 70 cents net per first

75,000 cu. ft. and then gradually coming down to 55 cents for 225,000 cu. ft. or over.

The system will be ready for use in time for this year's automobile show, which will be held January 20-25, 1913, under the direction of H. V. Buelow, manager

HOLDING GAS HEATER.

of the Toledo Industrial Exposition Company. On this occasion, the installation here described will be put to its first practical test and, no doubt, further data obtained.

Office Practice in Estimating Heating and Ventilation for Factories.

One of the questions asked by Mr. John D. Small in connection with his investigation to secure data on office practice in estimating heating and ventilating (THE HEATING AND VENTILATING MAGAZINE for August, 1912) is as follows.

"In your opinion is it feasible to heat a factory building comprised of two or more typical floors by running pipe coils around the outside walls, any given number of pipes high, regardless of the contents of floor area?"

In other words, he asks: After providing for losses due to exposed glass and wall surface, shall we add any radiation for contents or floor area?

When the radiation is shut off nights and Sundays or holidays, the volume of air enclosed within the room sometimes becomes chilled. When starting again, this air should be warmed in a reasonably short time. Therefore, extra radiation should be installed to do the work, over and above the amount allowed for other heat losses.

The greater the volume of air or contents of a room, proportionately less additional radiation is required to heat it, because, as Mr. Small states, "there is a certain percentage of a room of large dimensions which may be neglected with regard to air change." Most factory floor plans, at first glance, appear to be similar, but close analysis of conditions usually shows that an amount of radiation, ample to heat the one, would fall short of heating the other.

When estimating factory radiation, local conditions should be carefully noted and each of them given due consideration. High-posted rooms require more radiation than low rooms, because of the tendency of warm air to rise. Overhead coils in high rooms, with no moving belts or machinery, are not nearly so efficient as sidewall coils under windows. Open doorways, windows, stairwells, lifts, belt holes, etc., with their attendant air currents, are often more weighty factors than mere air volume. Even when there is a minimum of such openings, extra radiation is estimated for the lower floors of a mill or factory, to compensate for the upward flow of warm air. Cold floor and roof areas, wind exposure, and leakage also are important factors.

The intended use of the room, and adjoining rooms, should be ascertained. Spinning frames, slashers, dryers, dye tubs, ovens, kettles, vapor pots, etc., produce surplus heat. Will the room be occupied by workmen in action, or at rest, and how many of them? What is the particular ventilation problem?

In the writer's opinion, it is not feasible to disregard *CONTENTS* and *FLOOR AREA*, except as these factors are separately considered along with other factors, some of which are mentioned above. Sometimes they all seem inextricably interwoven with each other. However, with a broad experience, authentic data, careful analysis of local conditions, and a good sense of proportion, the estimator usually arrives at just about the right amount of radiation.

E. W. SMALLMAN.

Boston, Mass., January, 1913.

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AS A choice bit of reactionary sentiment, we commend our readers' attention to the following item which appeared recently in various daily papers:

"Have we ever stopped to think how our ancestors two or three generations back lived and flourished with little or no ventilation in their sleeping apartments? The night air used to be considered a very dreadful menace to health and a sure inducer of colds. Bedrooms were kept closely shut, and yet our ancestors, many of them, were hardier than we and lived to good old ages. Animals burrow in their holes at night, breathing the same air over and over again, while birds and fowls tuck their heads under their wings. Of course, ventilation is absolutely necessary for proper comfort, cleanliness and health, but people have lived on little or none of it for hundreds and thousands of years."

The difficulty in properly answering a statement of this sort is that, in many respects, it is literally true. Cases will readily occur to almost anyone of people living and thriving under conditions of ill-ventilation that are almost unbelievable. It is one of the peculiar features of the heating engineer's work that he must not only meet the technical problems involved in his designs, but must also cater to, or at least play the part of diplomat to, those of his clients who hold views more or less similar to those here quoted. A recent speaker has shown, for instance, how the ventilation of the Capitol at Washington has undergone numerous modifications from time to time purely and solely to meet the vagaries of new sets of legislators.

Of course, the sentiments quoted only go to show once more that the exception proves the rule. If it were worth while, formidable statistics could be presented, just to take one disease directly traceable to bad air, to show the ravages of consumption, in country districts especially, where the night air is most feared.

The fact is, however, that the heating and ventilating profession would lose some of its most picturesque elements if it were not for the presence of so many "lay experts" to egg it on.

NO ONE unfamiliar with normal American winter weather would suspect that we are at present in the throes of a winter season and had almost reached the middle of the heating period. The records for October, November and December of 1912 show a mean temperature so far above the average as to seriously raise the question again as to whether our climate is not changing. At any rate, it is certain that the remainder of the year must produce some exceptional cold spells to make up for the present accumulated deficiency.

THE CONSULTING ENGINEER

"The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

8—A Remedy for Insufficient Heating Capacity.

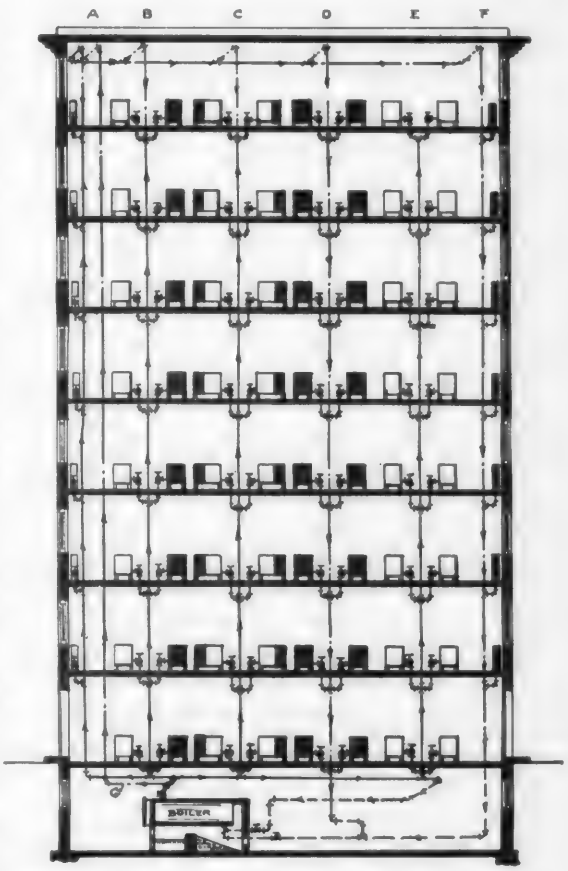
QUESTION—We have an 8-story building, with a one-pipe steam system, arranged as shown in the accompanying sketch. (Riser E.) The supply main is located in the basement and is a continuous loop. The risers are taken off the top of the main and drop back into it. The radiator conections are taken off the risers on the ceiling of the floor below and have ample pitch. The amount of radiation actually in place is 6,000 sq. ft. and the boilers and mains are of suitable size to carry 20% increase. To properly heat the building, 11,000 sq. ft. of radiation is necessary. How can this job be brought up to standard without removing or changing any of the piping?

ANSWER—In a single-pipe job, a fall is necessary between the radiator and riser to overcome any possible difference in pressure and relieve condensation.

There are two ways of increasing the capacity of a heating system. One is by raising the pressure and tempearture of the heating medium; the other is by increasing the raidation, adding, for instance, more sections to the radiators already in place. Either of these methods of increase would tend to make a greater difference in pressure between the riser and radiator and might cause the job to fail.

The drop through the thickness of the floor will give a pretty good fall, but the radiators on the lower floors may hang up, due to the higher pressure at the base necessary to fill the increased capacity in radiation with steam.

In the accompanying illustration, several methods are shown which may be used to increase the radiation and the capacity of the system without interfering even with the operation of the old system. Riser E shows the original installation. Riser G is a new riser run to the roof or to any intermediate floor, if desired, supplying a new system of overhead mains, which will be considered smaller than the present system. Riser G may be connected to the present boiler, or to a new boiler, if the



SKETCH SHOWING METHODS OF REMEDYING INSUFFICIENT HEATING CAPACITY.

Riser E, Original Installation.

old one is not of sufficient capacity. The boilers and system may be cross-connected so as to operate in conjunction.

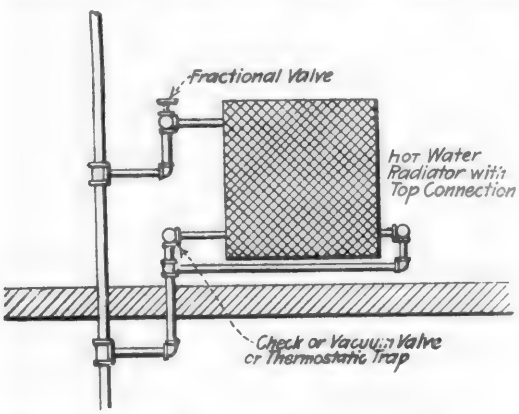
Riser C shows how the radiators may be disconnected and new sections added up to the capacity of the present connection. Riser D is entirely new, connected from overhead and is a separate return carried back to the boiler or boilers. Riser B shows how, where possible, a new line of radiators may be connected to the old riser.

All risers which would be overloaded with the new radiation may be connected to the overhead main as shown, carrying the new connections down two floors, if necessary, where the last riser connection may be too small. By properly arranging the connections, this will increase the capacity of the plant with practically no changes that would require a shut-down for more than a few hours, while the connections are being tied into the old system. A drip didectly at the base of the old risers, if they still are inadequate, and connected to the new return pipe, will increase the capacity of the system still further. This method has frequently been employed where single risers have been overloaded, in order to equalize the pressure and cause the condensation to fall out of the system. The supply pipe may be run in any out-of-the-way place and connected to the top of the old riser.

9—Arranging a Modulated Steam System for Water Radiation.

QUESTION—Can a modulated steam system be arranged with water radiation for a single-pipe riser?

ANSWER—Yes, by connecting the supply to the top of a hot water radiator with a modulating valve in the same manner as if there were two pipe risers. The return can be connected with check back into the same riser



ARRANGEMENT OF MODULATION SYSTEM FOR ONE PIPE, DOWN FEED.

lower down, instead of using a separate return. It would be of advantage to carry this return through the floor and connect it in the ceiling of the floor below, thus obtaining a 1-ft. or 2-ft. fall on the return from that radiator. An overhead downfeed system is contemplated in this description.

10—Figuring Static Pressure of Friction Loss in Fan Work.

QUESTION—In figuring the static pressure of friction loss against which a fan must work, where it draws or discharges the air through a system of galvanized iron pipes, should the friction loss throughout the entire system be figured or only in the longest run of pipe, without including the branch outlets except at the extreme end of the run, and why?

ANSWER—This subject is thoroughly and ably treated in a bulletin issued by the Green Fuel Economizer Co., Matteawan, N. Y. (No. 137); also in a very complete treatise by Konrad Meier on "Mechanics of Heating and Ventilation." Quotations from the former will be used, as the allotted space will only allow a brief discussion of the question in hand.

As a rule, the position of outlets, as well as quantity of air for each, is given in the determining of a system of galvanized iron ducts. The pipe sizes should be adjusted so that there is the same total resistance between the fan and each individual outlet when the required amount of air is being discharged. The furthest outlet is taken for trial, in order that with a moderate pressure at the fan the delivery of the air will be accomplished without too great an expense in duct work. The higher the pressure, the greater the horsepower, speed of fan and air velocity and the less the expense in duct work required.

These two factors, operating expense and investment, are what determine an economical layout. The friction varies directly as the square of the velocity and, therefore, smaller ducts mean higher resistance. Quoting from Bulletin No. 137, already referred to, there are two principles which bear on the question asked:

"When different resistances are passed in series by the current of air, the total resistance of the circuit is the sum of the pneumatic resistance of the several parts, taken in series. This subtracted from the total head, gives the velocity head to produce flow. This sum will be the same for all outlets and equal to the total available head, whether the desired amount of air is delivered or not.

"Also, the combined air-passing capacity of orifices or channels in area to the sum

of the areas of the equivalent thin-plate orifices for the separate channels."

In addition to the rules here given, the bulletin contains an excellent table of friction heads worked out for all sizes of round pipes which the writer has checked with other authorities and has found it to be accurate. In large duct systems, the outlets and duct sizes have to be determined by trial and error. When the outlets are symmetrical and the distances comparatively short, an equalization table may be used.

In using the friction table, above referred to, for square and oblong pipes, look up the round pipe having the same periphery as the square or oblong pipe, with the same velocity in feet per second as the square or oblong pipe. The result will be the friction of the oblong or square pipe.

Legal Decisions

Landlord's Duty to Heat Apartment.

The lease of an apartment provided that the landlord would, without additional charge, maintain proper heating and hot water appliances in the building of a size sufficient to supply a proper amount of heat and water to all the tenants at all proper times, and that, in case of the heating apparatus requiring repair or improvement, the landlord might omit such service until all necessary repairs had been made.

In a suit for the rental of the apartment the tenant testified that he had to move away from the apartment in the winter because it was uninhabitable by reason of insufficient heat. It appeared from other evidence that constant efforts at repair on the part of the landlord were made and that these efforts were not effective in restoring the premises to a properly heated condition.

It was held that it was the landlord's duty to maintain proper heating and hot water appliances, and the apparatus installing being inadequate, to reconstruct it or introduce a new steam-heating plant; otherwise he could not hold his tenant for the rent.—Ollwerter vs. Escher, New York Appellate Division, 137 N. Y. Supp. 881.

Patents—Discharge Valve for Steam Radiator.

Suit was brought for infringement of the Van Auken patent, No. 828,153, granted under application filed August 1, 1903, for "improvements in valves for radiators." Both the usefulness and popularity of the device and the substantial improvement therein over pre-existing valves or traps for analogous purpose were established by the evidence in the case. The patent discloses a compact device of the well-known float-valve type, adapted for use in a vacuum system of steam heating.

It is provided with means, when attached to the radiator, to "continuously and automatically carry away the air" and "automatically and intermittently carry away the water of condensation, while at the same time forming such a barrier between the outlet pipe and the radiator" that "waste steam" is prevented. "Placed on the discharge of the radiator" and connected "with the return line in the vacuum system," it "automatically separates the air and the water of condensation from the steam and discharges the former while retaining the latter."

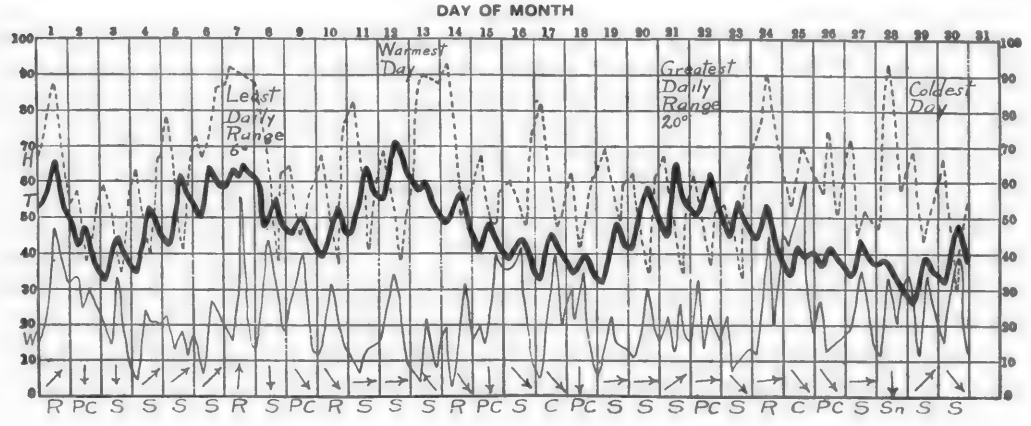
It was held that the patent was not anticipated by prior inventions, and that it disclosed invention; but it was also held that its scope of invention was limited by prior disclosures, and that the claims were not generic, but must be limited to the particular means in combination specified in the patent and drawings. As thus defined it was held that the claims were not infringed by the defendant's Boegen valve or Leuthesser valve.—Van Auken vs. Monash-Younker Co., Circuit Court of Appeals, Seventh Circuit.

Directors of Heating Corporation Held Not Liable Individually.

A contract was entered into for the construction, by a corporation, of a hot-water heating plant. Work was commenced on the contract on November 15, 1909, and was completed and the final payment of the price made on May 23, 1910. The plant was tried in the autumn of 1910, and, claiming that it was not constructed in accordance with the guaranty, the buyer, on March 31, 1911, sued for breach of the contract. Execution was returned unsatisfied. He then commenced suit against the directors of the corporation upon their statutory liability for debts contracted by the corporation while they were in default as to the making and filing of the annual report of the corporation for the year 1910. It was held that the directors were not liable, since the corporation's liability was incurred at a time when the directors were not in default in filing the 1910 report, so that the judgment was not a "debt contracted" since the filing of the last report within the statute.—Weber vs. Draper, Michigan Supreme Court.

The Weather For November, 1912

	New York.	Boston.	Pittsburg.	Chicago.	St. Louis.
Highest temperature, degrees F.	71	70	70	70	76
Date of highest temperature	12	12	6	11	10
Lowest temperature, degrees F.	27	24	25	25	26
Date of lowest temperature	29	29	28	28	24
Greatest daily range, degrees F.	20	24	25	20	25
Date of greatest daily range	21	4	1	19	18
Least daily range, degrees F.	6	7	4	7	8
Date of least daily range	7	16	15	7	14
Mean temp. for month, degrees F.	46.6	46	44	42.8	47
Normal mean temp. for month, deg. F.	44	41.2	42.9	39.2	43.4
Total rainfall, inches	2.21	2.61	0.8	1.45	1.76
Total snowfall, inches	0.8	0.3	0.3	0.4	trace
Normal precipitation, this month, inches	3.44	4.1	2.55	2.5	2.88
Total wind movement, miles	14,886	8,564	10,129	11,052	8,639
Average hourly wind velocity, miles	20.7	11.9	14.1	15.4	12
Prevailing direction of wind	NW.	W.	W.	W.	S.
Number of clear days	12	13	9	12	20
Number of partly cloudy days	10	4	7	10	2
Number of cloudy days	8	13	14	8	8
Number of days on which rain fell	9	7	6	8	4
Number of days on which snow fell	1	2	2	1	..
Snow on ground at end of month, inches	..	..	..	..	..


DAY OF MONTH
Warmest Day
Greatest Daily Range 20°
Coldest Day
Least Daily Range 6°
H
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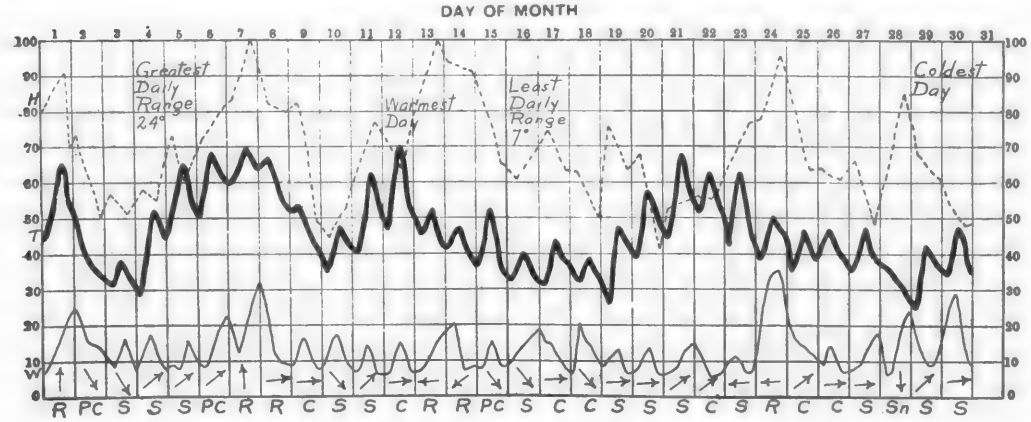
RECORD OF THE WEATHER IN NEW YORK FOR NOVEMBER, 1912.
(Hourly observations of the relative humidity are plotted on this chart).


DAY OF MONTH
Greatest Daily Range 24°
Warmest Day
Least Daily Range 7°
Coldest Day
H
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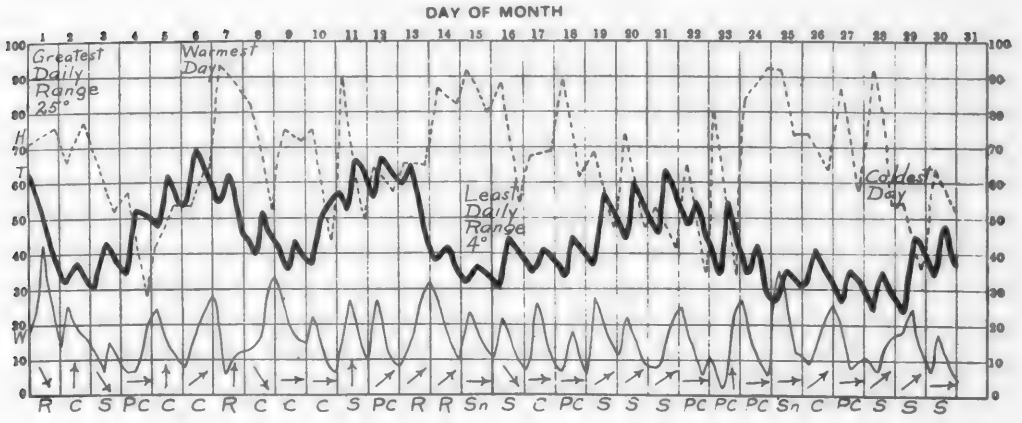
RECORD OF THE WEATHER IN BOSTON FOR NOVEMBER, 1912.


DAY OF MONTH
Greatest Daily Range 25°
Warmest Day
Least Daily Range 4°
Coldest Day
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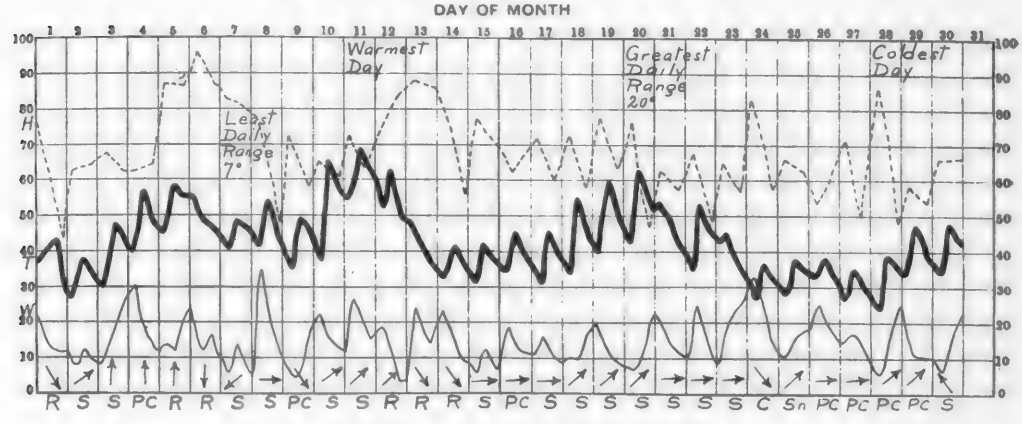
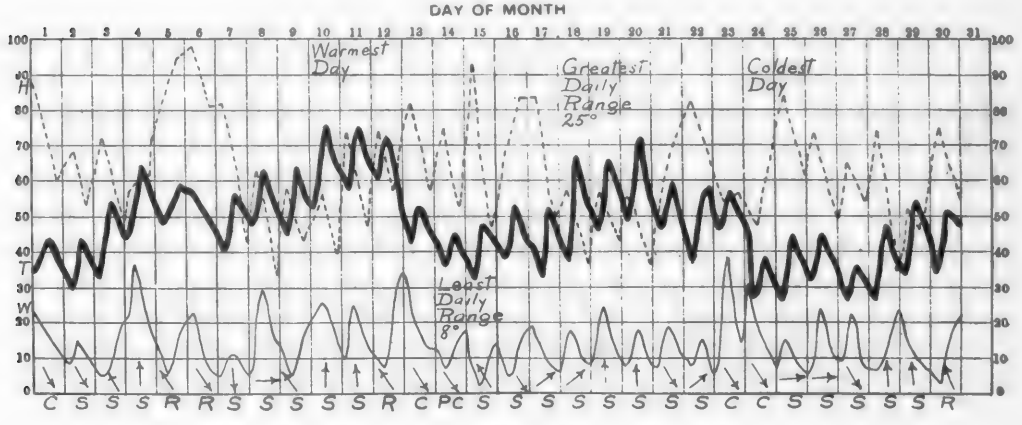
RECORD OF THE WEATHER IN PITTSBURG FOR NOVEMBER, 1912.


DAY OF MONTH
Warmest Day
Least Daily Range 7°
Greatest Daily Range 20°
Coldest Day
R S S PC R R S S PC S S R R R S PC S S S S S S C Sn PC PC PC PC S

RECORD OF THE WEATHER IN CHICAGO FOR NOVEMBER, 1912.



RECORD OF THE WEATHER IN ST. LOUIS FOR NOVEMBER, 1912.

Plotted from records especially compiled for "The Heating and Ventilating Magazine," by the United States Weather Bureau.

Heavy lines indicate temperature in degrees F.

Light lines indicate wind in miles per hour.

Broken lines indicate relative humidity in percentage from readings taken at 8 a. m. and 8 p. m.

S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.

Arrows fly with prevailing direction of wind.

Current Heating and Ventilating Literature

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

Hot-Air Heating.

Blower Heating in Bank Building. Illustrates and describes details of mechanical equipment, including fuel oil fed heating boiler, air washer, fresh air and exhaust ducts and vacuum cleaning provisions. 2,000 words. Met. Work. Oct 4, 1912. 20 c.

Piping.

Steam Power Plant Piping Materials. William F. Fischer. Considers the Materials used and the strengths and weights of the various thicknesses. 1,500 words. Power. Oct. 1, 1912. 20 c.

Steam Heating.

Heating and Ventilation in Post Office at Jersey City, N. J. H. L. Alt. Plans and description of the direct steam heating system, the indirect fresh air system, and the exhaust or foul air removal system. 3,500 words. Dom. Engng. Oct. 12, 1912. 20 c.

Heating and Ventilation of a Large Store. Illustrates and describes details of equipment of a store in Memphis Tenn. 1,800 words. Met. Work. Oct. 11, 1912. 20 c.

Ventilation.

Moistening Mine Ventilating Currents. A. A. Steel. Discusses the use of steam jets and water sprays, and methods of avoiding fog and undue dampness. 3,000 words. Mines & Min. Oct., 1912. 40 c.

Wind Velocity.

The Electrical Measurement of Wind Velocity. J. T. Morris. Gives details of a method in which an electrically heated wire is kept at a constant temperature when exposed to a current or air. Describes experiments and gives results. 3,500 words. Elect'n, Lond. Oct. 4, 1912.

New Instruments for Measuring Air Velocity (Neuere Instrumente zur Messung der Luftgeschwindigkeit). Carl Wieselsberger. Describes recent improvements in the design of electrically connected anemometers. Ills. 2,200 words. Elek Rund. Sept. 26, 1912. 60 c.

Vapor Disposal.

Vapor Disposal System in a Dye-House. 1 fig. 800 words. Eng. Rec. Oct. 19, 1912. 20 c.

Dust Collecting Systems.

Design of Dust Collecting Systems. F. B. Jacobs. A consideration of the various units that enter into the construction of dust-collecting exhaust system. 1,100 words. 7 figs. Am. Mach. Oct. 10, 1912. 20 c.

CORRESPONDENCE

Admitting Cold Air to Rooms.

Editor HEATING AND VENTILATING MAGAZINE:

In my talk at the conference which I conducted at the Brooklyn Institute of Arts and Sciences, December 7, I may have conveyed the idea that I was entirely opposed to the admission of fresh cold air in habitations under all conditions. That was not my intention. In the case of school rooms, however, I must remain opposed to admitting large quantities of cold air by windows, at least until it can be done without subjecting some or all of the children to cold drafts.

When admitting the air warm or cold, to a school room in New York, Massachusetts and Connecticut, we must remember the laws relating to the quantity required. If this quantity is admitted regularly and systematically, it will amount to about 1,500 cu. ft. per minute if the radiating surface in the room is sufficient to keep all the air within the room, and the air that is being added to it at a living temperature. I can understand how this may be done through perforated cornices with the result of securing reasonable "mixing" of the air temperatures within the room, but I cannot see how it can be done through two or three open windows, even if distributed over the whole time.

In the matter of "flushing" by opening the windows for 5 or 10 minutes now and then it seems impossible to secure the amount required by law. Under the "flushing" process, 90,000 cu. ft. of fresh air would have to be admitted in the 5 or 10 minutes, with one flushing to the hour, and this would be impossible; as an ordinary class-room contains only about 12,000 cu. ft. of space and would have to be "flushed" once in about each 8 minutes. So there would be no time for anything else than "flushing." The term "flushing" is not yours, and I believe you do not advocate it as a cure, but it has emanated from some of the physiologists who would settle this matter in a newspaper interview. I am, therefore, forced to the conclusion that it is impossible to "flush" class-rooms through open windows and comply with the law.

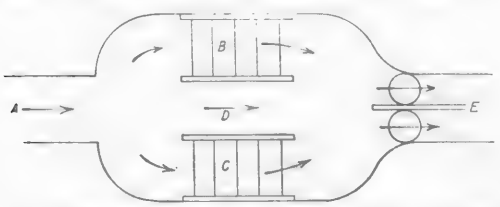
I find no fault with partially opening a class-room window, but it must be auxiliary to the systematic air supply and it should not blow cold or hot on a child—delicate or strong.

WOULD MIX THE COLD AND WARM AIR BEFORE ADMITTING IT TO ROOM.

Before leaving the subject, I would like to ask the advocates for the admission of 90 000 cu. ft. of cold air to a class-room in an hour, (to be mixed with the warm air after it enters the class-room), why it would not be better to mix the cold air with the warm air before it enters the room and then send it in at about 70 degrees F. This is what I intended to bring out in my lecture and I would go even a little further. . I explained that the humidity or hygrometric conditioning of the air could be accomplished by the use of the "mixing valve," just as well as the regulation of the temperature. This can be done by having two sets of heating coils, as shown on the accompanying diagram.

NOVEL METHOD FOR REGULATING HUMIDITY.

The air passing through each set of coils can be warmed to 100 degrees F., or thereabouts, and the air passing through the cold air opening can be taken as low as it comes. Now the warm air from one set of heating coils is admitted at 100 degrees F., but as dry as possible, and the air through the other set of heating coils at the same temperature (100 degrees F), but as saturated as possible (the additional saturation being supplied by steam or water vapor.) Then, we can admit a given quantity of hot air dry, plus a given quantity of hot air saturated. In this way we would have a resulting mixing-temeperature of about 70 degrees F., saturation about 50 per cent. with a difference on the hygrometer of about 10 degrees F.



A—Fresh air inlet; B—Hot dry air; C—Hot saturated air; D—Cold air passage; E—Air mixed as to temperature, quantity and humidity.

PROPOSED ARRANGEMENT FOR HUMIDIFYING AIR IN HEATING SYSTEM.

With this arrangement, if one wants to decrease the relative humidity, he can admit less of the warm saturated air, or if one wants to increase the relative humidity, he can curtail the amount of warm air.

WILLIAM J. BALDWIN.

New York, Dec., 1912.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Suggested Topics for Annual Meeting.

In a circular sent to the members regarding the society's annual meeting in New York, January 21-23, the following topics for papers for discussion are suggested.

1. Ventilation in general.
2. Venilation of various classes of buildings.
3. Methods of ventilation having regard to air movements within a room.
4. The open window and ventilation.
5. Heat emission of indirect radiation.
6. Central station heating.
7. Forced hot water heating.
8. Vacuum heating in residences as well as large buildings.
9. Temperature regulation in residence heating.
10. Distance between water chamber and eliminator in air washers.
11. Data on solid material collected by the air washer.
12. Air cooling for buildings.
13. Testing steam and hot water boilers.
14. Testing warm air furnaces.
15. Rating radiators.
16. Air space in direct radiators.
17. Experiences with fractional radiator valve installations.
18. Securing humidity in direct radiation heating.
19. Vacuum cleaning.
20. Efficiency of labor element in heating industry.

The usual business sessions will be held Tuesday afternoon, January 21, while Tuesday evening, Wednesday morning and Thursday morning and afternoon will be devoted to professional sessions. The society dinner will be held Wednesday evening.

New York Chapter.

The design of the heating and ventilating plant in the St. Regis Hotel, New York, together with interesting data on its operation during the seven years it has been in use, were discussed in an address by Arthur K. Ohmes, before the New York Chapter of the heating engineers' society at its December meeting. Mr. Ohmes showed a chart giving the steam consumption of each of the principal units in the power plant for each hour of the day and explained at length the reasons for the variations that were observable on the chart. As this hotel is a 17-story building, the

effect of the height upon the heating was found to be of much importance. This led, at the close of his address, to an extended discussion of the neutral zone in heating.

Mr. Ohmes stated that the St. Regis power plant uses from 8,600 to 18,000 lbs. of steam per hour, the highest consumption being between 6 and 8 P. M. Between 9 and 10 A. M. there is frequently a deficiency of exhaust steam for heating purposes and live steam has to be added. The hotel is heated throughout, with one of two minor exceptions, with indirect heat, the fan blast apparatus being divided into four separate systems, located on various floors.

To prevent the motors from being noisy, cork insulation is used and this has been found effective.

Mr. Ohmes called attention to the impossibility of fulfilling some of the specifications such as, for instance, one that called for 62° in the ballroom, and 70° in the reception room adjoining, with no doors separating the two rooms.

Regarding the effect of the height of the building on the heating, Mr. Ohmes stated that on the eleventh floor the heat supply was found to correspond exactly to the calculated requirements, but that above the eleventh floor the apparatus supplied less than was required. On the other hand, at the first floor level, the radiation required exceeded the estimated requirements by 108%. The latter tremendous excess of heat supply over the calculated requirements he considered partly due to the active exhaust ventilation of the underground portion, but mostly due to the up-draft in the building induced by the different air pressures within the building. These results made the window heat transmission coefficients vary on the different floors from ½ to 5, depending on the different air pressures.

It is thus evident, said the speaker, that when the air pressures on buildings are taken into account the usual figures for heat transmission are not accurate.

Mr. Ohmes also spoke on the effect of the "fresh air craze" which, he said, was much in evidence among the patrons of the St. Regis, who insisted on opening their windows wide during the night and then expected the room to heat up promptly in the morning. In one case, said the speaker, this froze the water pipes in that room, while it took most of the ensuing day to bring the room to normal temperature again. Where dressing rooms adjoined the sleeping rooms it had been found that cold air would back up in the air duct and chill the dressing rooms, much to the disgust of patrons who expected a temperature of at least 70° to dress in.

Action was taken by the chapter on the matter of standardization of salaries which is being undertaken by the Board of Estimate and Apportionment of New York. A letter on the subject from Comptroller Prendergast had been referred to the chapter by the board of governors of the society. The matter was referred to the chapter's committee on professional fees to suggest maximum and minimum fees for each grade referred to in the comptroller's letter.

The matter of incorporating the chapter came in for further discussion and it was decided on vote not to incorporate for the present.

Sub-Committees on Entertainment for Annual Meeting.

Homer Addams, chairman of the entertainment committee, appointed by the New York Chapter to assist the officers of the society at the annual meeting, January 21-23, has announced the appointment of the following sub-committees:

EXECUTIVE AND FINANCE.

F. T. Chapman.
W. S. Timmis.
F. K. Chew.
A. S. Armagnac.

ENTERTAINMENT.

A. S. Armagnac.
R. C. Taggart.
P. A. Hoffman.

DINNER.

W. S. Timmis.
R. B. Hunt.
C. E. Scott.

Illinois Chapter.

"Air Washers, with a Specific Consideration to Humidity Control," was the topic for the December meeting of the Illinois Chapter at Vogelsang's Restaurant, Chicago, December 9. The speaker of the evening was Frank L. Busey, of the Buffalo Forge Co., who showed a number of lantern slides covering the development of the air washer.

The chapter has published its Year Book giving the subjects and dates for the remainder of the season, as well as its constitution anad membership list.

Illinois Chapter Issues Year Book.

The Illinois Chapter's year book, containing the programme for the 1912-1913 season, together with a list of members, present and past officers and constitution and by-laws, has been issued by Secretary Will L. Bronaugh. The membership list now comprises 35 full members, 7 asso-

ciates and 2 juniors. The programme for 1913 is as follows:

January 13: "Conditioning of Feed Water," oil, corrosion, scale and odor, with papers on water softening dealing with the elimination of scale in boilers and whether steam or vapor passing into rooms from air vents is detrimental to the best sanitary conditions. John D. Small, chairman; Charles F. Newport and W. B. Graves.

February 10: "Expense of Operating Heating and Ventilating Plants," power, fuel, etc. Methods of computing operating cost in advance of construction, etc. H. M. Harte, chairman; N. L. Patterson and G. W. Hubbard.

March 10: "Ventilation; Progress of the Tests at the Experimental Room at the Chicago Normal School," by F. W. Shepherd. Report on progress of compulsory ventilation laws, by Dr. W. A. Evans. J. H. Kassa, chairman; H. W. Ellis and George H. Kirk.

April 14: "The Heating and Ventilation of Large Manufacturing Plants," general discussion and exhibit of plans of a number of unique installations. August Kehm, chairman; W. A. Pope and R. M. Stackhouse.

May 12: Subject and committees to be announced.

Massachusetts Chapter.

At the December meeting of the Massachusetts Chapter, Messrs. Frank Irving Cooper, W. M. McKenna, A. B. Franklin and J. W. H. Myrick were appointed a committee to draw up a bill similar to the New York State law for the separation of heating and ventilating contracts from the general contracts, and to introduce such bill at the forthcoming session of the Massachusetts legislature; also to confer with other societies and associations interested in such a measure.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Date Set for Annual Convention.

Announcement is made that the twenty-fifth annual convention of the National Association of Master Steam and Hot Water Fitters will be held June 23-26, 1913. The board of directors has not yet decided on the convention city. Milwaukee, Wis., and Niagara Falls are being considered.

Visit to Testing Laboratories.

A party made up largely of members of the New York and Boston Chatpers of the American Society of Ventilating Engineers made a trip early in December to the boiler and radiator plant of the H. B. Smith Co., at Westfield, Mass., followed, the next day, by a visit to the Mason Laboratory of Yale University, at New Haven, Conn. The party was composed of James A. Donnelly, of New York, who organized the trip, and J. I. Lyle, Conway Kiewitz, Frank T. Chapman, C. Teran, George Schmidt, Frank K. Chew, Charles J. Lang, T. F. Murphy, C. D. Fundinger and J. C. Faulkner, and Charles A. Miller, manager and assistant manager, respectively, of the H. B. Smith Co.'s New York branch, all from New York; also Frank Irving Cooper, J. W. H. Myrick, A. B. Franklin, W. M. McKenna and J. G. Bresnahan, of Boston; and T. J. Morris, of Springfield, Mass.

The party spent the first night in Springfield, Mass., inspecting that evening the heating and ventilation of the International Y. M. C. A. Training School in that city. The visit to Westfield was made the next day and included an inspection of the H. B. Smith Co.'s testing station, as well as its boiler and radiator plant. After spending the day as the company's guests, the party returned late in the afternoon to Springfield where they were given a dinner by R. D. Reed of the H. B. Smith Co.

Leaving the next morning for New Haven the party was received at the Mason Laboratory by Prof. L. P. Breckenridge. Here the visitors were shown the laboratory's testing equipment which included apparatus for testing boilers and hot blast heating combinations. Two H. B. Smith Co. boilers are now under test at the laboratory, and the statement was made by Prof. Breckenridge that the laboratory would gladly cooperate with the heating engineers' society in making further tests.

A dinner at Heublin's Restaurant in New Haven brought the visit to an end and the party broke up with expressions of pleasure at the success of the trip and congratulations to Mr. Donnelly for his success in bringing it about.

American Society of Agricultural Engineers

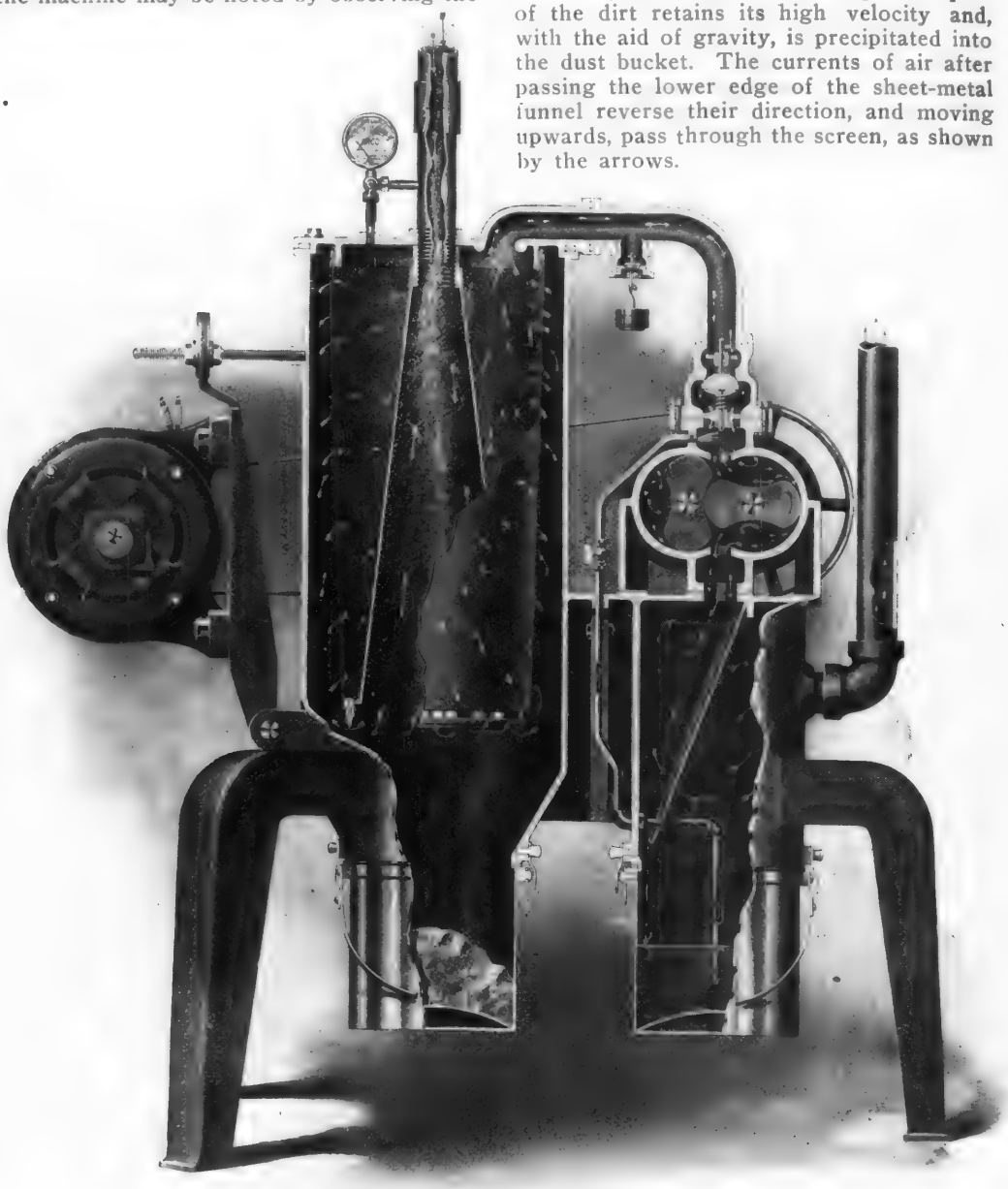
Among the papers read at the recent meeting of the American Society of Agricultural Engineers, held in Chicago, December 27, last, was one on "The Principles of Fuel Oil Engines," by C. F. Hirshfield.

Modern Vacuum Cleaning Apparatus

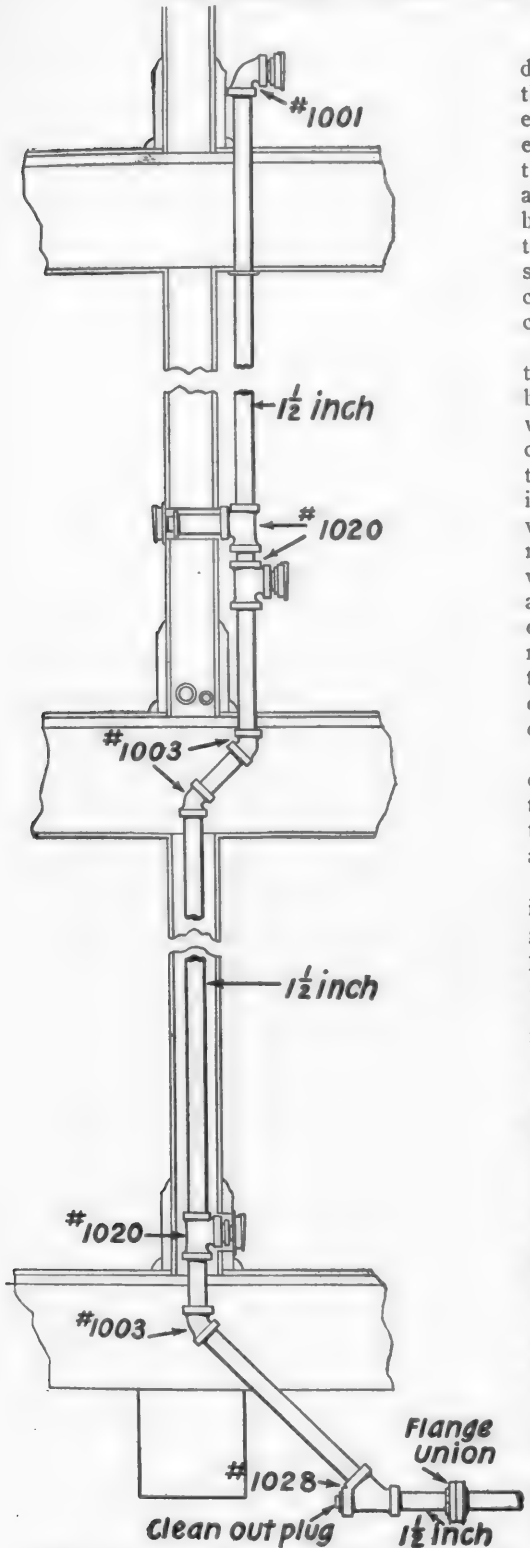
2—The Arco Wand Vacuum Cleaner.

The Arco Wand vacuum cleaner, for single sweeper plants only, is a stationary machine to be installed in the basement or other convenient place in building and connected by means of iron pipe with inlet couplings located in the baseboards of the floors above. The construction and operation of the machine may be noted by observing the air-travel through the machine as indicated by the arrows in the accompanying illustration.

When the machine is in operation the dirt-laden air enters at the top of the separator through the cleaner-main. Upon entering the sheet-metal funnel of the separator the air expands and its velocity is materially reduced, while the greater part of the dirt retains its high velocity and, with the aid of gravity, is precipitated into the dust bucket. The currents of air after passing the lower edge of the sheet-metal funnel reverse their direction, and moving upwards, pass through the screen, as shown by the arrows.



SECTIONAL VIEW OF ARCO WAND VACUUM CLEANER.



Copyright. 1911, by the American Radiator Co.

TYPICAL VACUUM CLEANING RISER, CONCEALED IN PARTITION OF FIRST STORY AND EXPOSED IN ROOMS ABOVE ON ACCOUNT OF OBSTRUCTION IN PARTITION OF SECOND FLOOR.

The screen is a double fabric made of duck and muslin, and is cylindrical in form, the lower edge being bound to the lower edge of the metal funnel, while the upper edge is fastened to the top of the separator. This screen serves to remove from the air any dust and dirt which has not already been precipitated into the dust bucket by the action of gravity. The condition of the screen can be tested at any time and it is cleaned by momentarily reversing the air currents through the screen itself.

From the separator the air passes through the pipe-connection to the pump, as shown by the arrows. It will be observed that a weighted relief valve is provided in this connecting pipe. The weights supplied for this valve are marked with a number showing the vacuum in inches, mercury column, which each represents. The action of this relief valve is designed to prevent the vacuum in the machine from exceeding the amount represented by the weights attached to the valve, in this way protecting the motor from becoming overloaded and protecting rugs, draperies, upholstering or other fabrics from injury in the process of cleaning.

A check valve is also located in this pipe-connection just above the pump. When the motor is stopped and the suction ceases this valve seals and prevents a back-rush of air through the separator and piping.

The pump is rotary, of the cycloidal type, in which a pair of impellers like a two-tooth gear revolve within a casing. These impellers do not touch each other or the casing at any point, obviating the possibility of friction or wear within the pump, and both impellers and casing are constructed of material that will not rust.

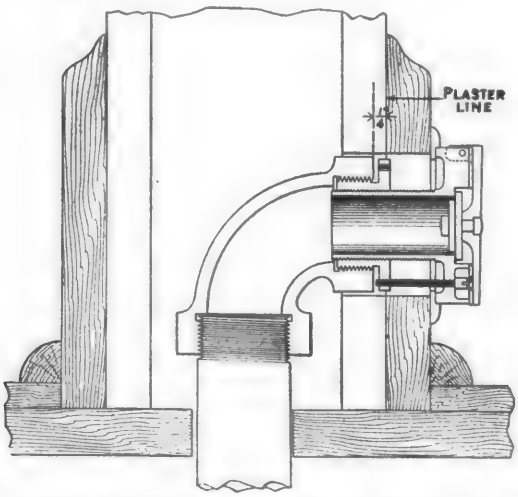
The complete Arco Wand pump is supported and carried on the main shell or body. Thus the pump is self-contained and may be unbolted and removed from its position on the cleaner without disturbing the alignment of any of its parts. The gears are located between the bearings, thereby distributing the load upon the shafts and bearings.

From the pump the air passes into a muffler, to prevent noise caused by its discharge from the pump. The air then passes through the exhaust pipe and is carried into a vent flue or outdoors. All air used in cleaning is removed from the building.

The bucket attached to the muffler carries water, a small supply of which circulates through the pump when in operation, closing the minute spaces between the parts to the passage of air. The pump when operating creates a suction through the small pipe. This causes water to flow from the bucket up through the small pipe, and it is

delivered into the top of the pump with the inrushing air. Here the water is separated from the air and runs back into the bucket to be used again.

This constant circulation of water through the pump also serves to take any light flying dust that may be carried by the air after having passed through the screen and this dust will eventually settle in the form of sediment in the bottom of the water bucket.



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ARCO INLET COUPLING IN PLACE.

This insures an absolutely clean exhaust without any objectionable clouds of dust to be emptied into the vent flue or outdoors.

Arco Wand vacuum cleaners are equipped with electric motors which transmit power to the pump by means of a belt drive. The motor is mounted on a bracket which provides means for tightening the belt. When other motive power than electricity is to be used, the Arco Wand vacuum cleaner can be supplied without motor.

For all ordinary residence work, with this apparatus, 1½-in. pipe is ample for all cleaner-mains and risers, and larger than 2-in. pipe is never required. The Arco Wand vacuum cleaning systems are manufactured and sold by the American Radiator Co., Chicago.

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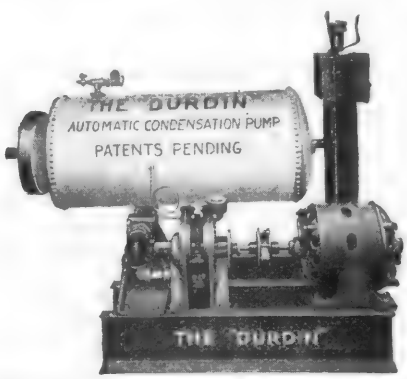
INLET BUSHINGS.

A New Automatic Electric Condensation Pump.

An automatic tilting tank receiver, built without float or mechanism of any kind, for use in connection with an electric condensation pump, has recently been placed on the market by the Chicago Pump Co., Chicago, Ill., under the name of the Durdin pump, and is illustrated herewith. The receiver is balanced by counterweight on specially-designed brass trunnions and is caused to tilt by the weight of the condensation water which flows into it. The tilting of the tank operates the automatic switch and the motor and pump are thus put into operation. When the water has been pumped back to the boiler, the counterweight brings the receiver back into its original position, cuts out the switch and thus stops the motor and pump. It will be seen that the frequency of operation is governed by the quantity of condensation water in the system.

The elimination of floats in the receiver is one of the most interesting features of this apparatus. In this respect, the danger is eliminated of the floats becoming opened up and water-logged, through their expansion and contraction, caused by the great



DURDIN AUTOMATIC CONDENSATION PUMP.

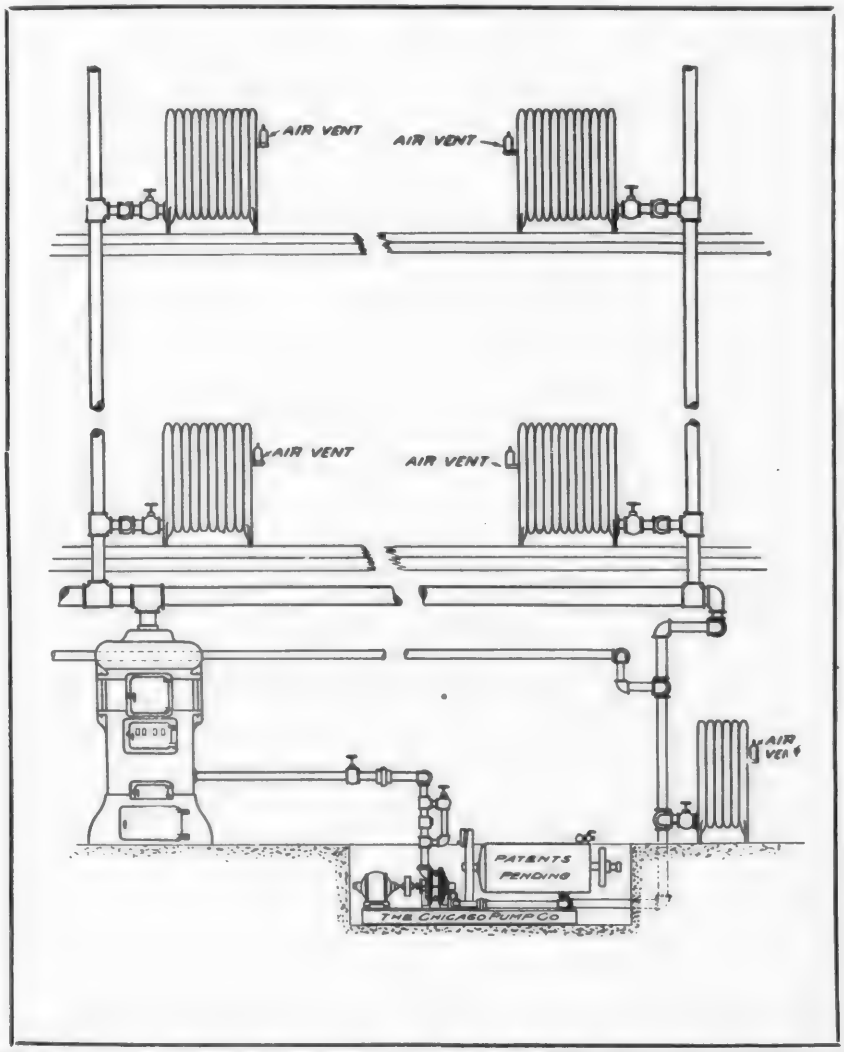
changes in the tempeartures in the receiving tank.

In the accompanying view of a typical steam heating installation equipped with the apparatus here described, it will be noticed that the condensation pump is placed below the lowest radiator in the system. If the lowest radiator is on the basement floor it is necessary to place the outfit in a pit. This is so much simpler, however, than placing the boiler in a pit that it is figured that a reliable condensation pump will save its own cost before installation in new buildings through the elimination of the boiler pit from the specifications.

In addition to this, it is stated that the automatic electric condensation pump will effect a continuous saving of from 20% to 50% in the coal used, according to the type and size of building in which it is installed.

This apparatus operates in the usual way, the condensation water and air flowing by gravity into the receiving tank from which the air is allowed to escape through a pet cock and the hot condensation water pumped back into the boiler. Each pumping operation leaves a reduced pressure in the receiving tank which accelerates the downward flow of the condensation water and air. The radiators being thus continuously freed from condensation water and air, are uniformly heated with low boiler pressure.

The manufacturers call attention to the exceptionally high-grade turbine pump and motor used with their outfits; the automatic switch is especially designed for this apparatus. Detailed descriptive matter on the Durdin pump may be had by addressing the Chicago Pump Co., at its home offices, 911 West Lake St., Chicago.



TYPICAL HEATING INSTALLATION EQUIPPED WITH DURDIN AUTOMATIC CONDENSATION PUMP.

An Instrument for Averaging Radial Ordinates.

The great increase in recent years in the use of circular diagrams or dial instruments for measuring and recording engineering quantities, such as pressure, temperature, electric voltage, current, electric power, flow of water, etc., has led to the demand for some type of instrument which will give a mean value of the ordinates of such a diagram in the same manner as does the ordinary planimeter for a diagram in rectangular coordinates. The use of a common

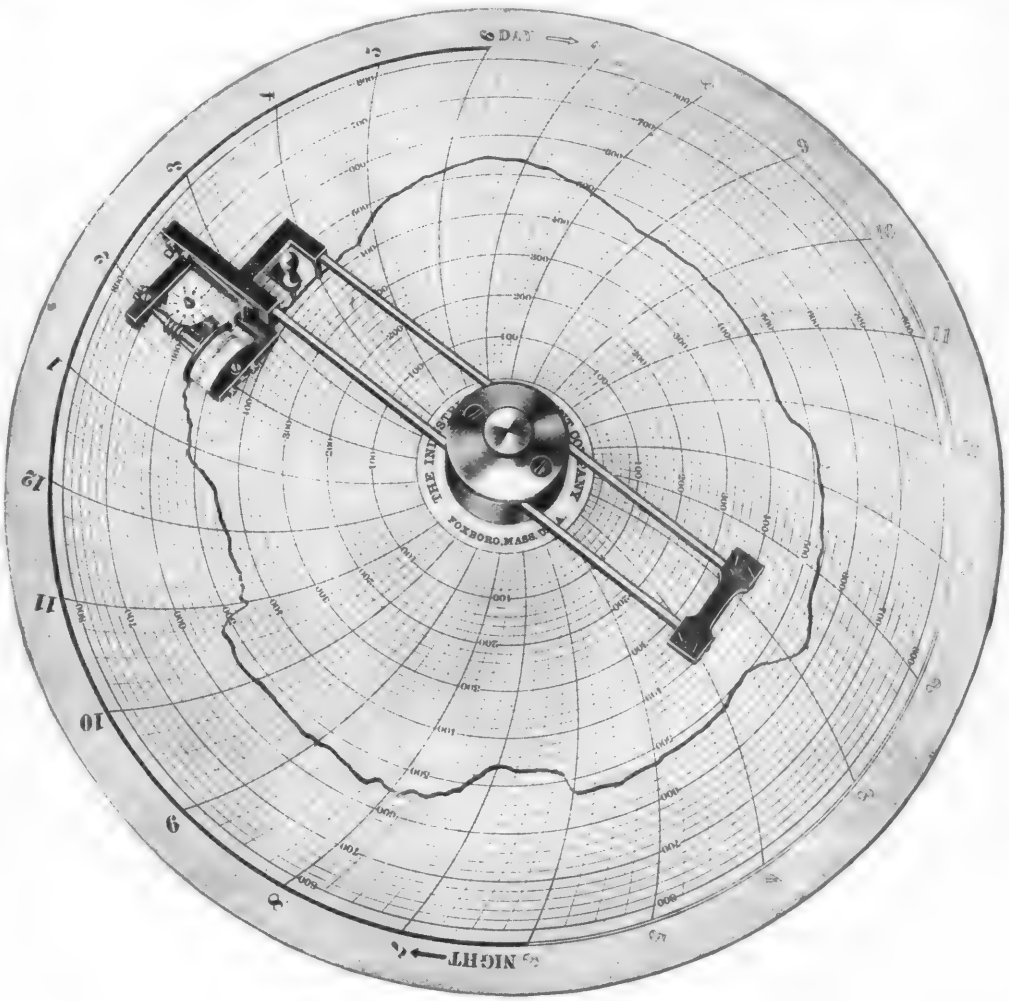
form of planimeter in connection with a radial diagram is impossible, since from the mathematical principles involved, it results that such application would give the mean square of the ordinates rather than the mean ordinate as desired.

A radial planimeter is now made in Switzerland by Amsler, Laffon & Co., the exclusive handling of which in this country has been obtained by the Industrial Instrument Co., Foxboro, Mass. The instrument is being sold by this firm under the name of the Foxboro Durand radial planimeter, the price being $35 net. The instrument is graduated to give mean ordinate in linear inches, so that by applying the appropriate scale factor it may be used for all diagrams, irrespective of the character of the engineering quantity recorded.

The principles upon which the instrument is constructed and operates are explained at length in a recent bulletin (No. 71) issued by the Industrial Instrument Co. Its principal features are (1) a base which is to be centered with the diagram or chart to be averaged, and carrying a pair of parallel guide slots; (2) a pair of rods working in the slots of (1) and carrying at their end a frame to which is attached a tracing point and a pivoted carriage for the integrating wheel; (3) the integrating wheel for measuring the record.

H. W. Johns-Manville Company Opens New Plant.

The new plant of the H. W. Johns-Manville Co., at Manville, N. J., started in operation with the new year. It consists of nine buildings which, together with their products, are classified as follows: (a) textile and packing; (b) rubber plant, electrical specialties and printing department; (c) pipe coverings; (d) paper mill; (e) magnesia; (f) roofing; (g) mastic and water-



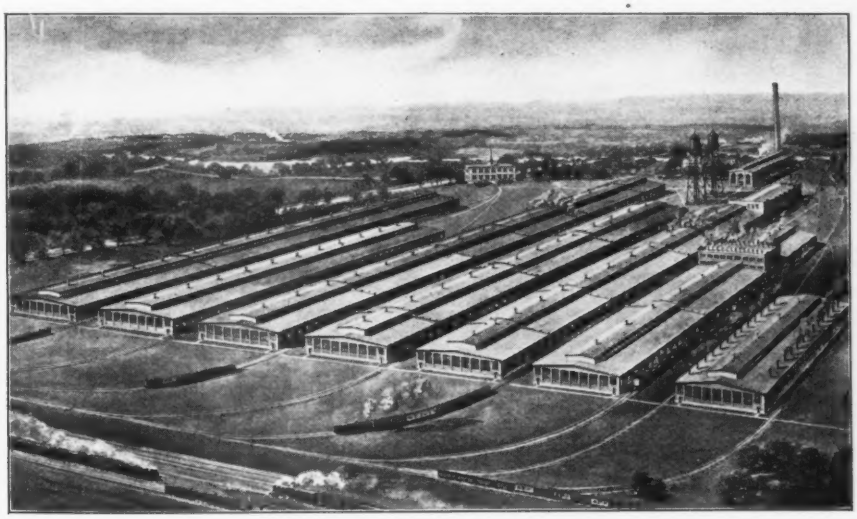
FOXBORO DURAND RADIAL PLANIMETER.

proofing; (h) roofing coatings, power plant and pump house. The buildings are of fireproof construction, being of brick, steel and concrete, with roofs of J-M asbestos roofing. The walls, ceilings and uprights are coated with J-M fireproof cold water paint. Artifical illumination is provided in the form of J-M linolite lamps and Frink reflectors. The "daylight" form of construction permits a floor of light to enter the building during the day through large triple-unit windows placed close together.

Ventilation is furnished by means of steel ventilating sash, designed to give a constant supply of fresh air without drafts. Each building has a naverage length of 1,-00 ft. and is a separate factory in itself capable of being operated as an independent unit. The total combined floor area of all the buildings is about 1,000,000 sq. ft.

Power is furnished by the company's power plant, which consists of General Electric turbo-generators, six Babcock & Wilcox water-tube boilers, aggregating 5,-000 H.P. All steam pipes are insulated with J-M asbestos sponge felted covering. The power and lighting cables, instead of being strung on overhead poles, are carried underground through J-M fibre conduit.

The buildings are heated by exhaust steam carried underground from the power plant through pipes laid in J-M sectional conduit. The new plant is located on a tract of 320 acres, divided by the Raritan River, in the town formerly known as Findern, but now changed to Manville. The company's private railroad system, comprising five miles of track, connects directly with the Central R. R. of New Jersey, the Lehigh and the Philadelphia & Reading. These roads have arranged to operate special work trains to and from Manville for the accommodation of employees living in nearby towns. About 3,000 men will be employed at this new plant, making a total of 7,000 men employed by the company.



H. W. JOHNS-MANVILLE CO.'S NEW PLANT AT MANVILLE, N. J.

New Books.

An Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries, by L. P. Breckenridge and G. A. Goodenough (a revised edition of Bulletin No. 9) has been published by the University of Illinois Engineering Experiment Station, Urbana, Ill. The filing and classification of engineering data has become a matter of much importance and this bulletin is prepared for use as a guide in carrying out such work. It presents subdivisions of subjects in such detail as to constitute a complete classification for most engineering industries. The revised bulletin has been made in accordance with the 1911 edition of "Decimal Classification" by Melvil Dewey. Copies may be had at 50 cents each, by addressing W. F. M. Goss, director of the university's engineering experiment station.

Heizungs, Luftungs und Dampfkraftanlagen in den Vereinigten Staaten von Amerika (Heating, Ventilating and Steam Power Plants in the United States of America) is a new book by Arthur K. Ohmes, consulting engineer of Nygren, Tenney & Ohmes, New York. The book, which is written in German, contains 119 illustrations and 8 tables, describing some of the most notable work of this firm, such as the plants installed in the Hotel St. Regis, New York; Chemical National Bank,

New York; Metropolitan Museum of Art, New York; residence of Andrew Carnegie, New York; Gimbel Bros.' department store, Philadelphia; the New Theatre, New York; Metropolitan Life Insurance Building, New York; Connecticut State Capitol, Hartford; University Club, New York; United Engineering Societies Building, New York; beside a number of American hospital buildings. Size 6½ x 9½ in. Pp. 182. Price, $1.50. Published in Munich and Berlin by R. Oldenbourg, or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

Trade Literature.

A Christmas Greeting Card, with an appropriate sentiment printed on a thin sheet of cork, is an attractive novelty received from the Armstrong Cork Co., Pittsburgh, Pa.

The Mueller Record, Christmas Number, the house organ of the H. Mueller Mfg. Co., Decatur, Ill., contains a number of items of special interest to the company's staff, including a capital cartoon of the "close of our 'Baseball' Season." Articles of more serious moment relate to "The Care of Tools," by Len Herman and "Broken Tapping Machine Tools," by J. J. Voelcker and George Coles; and "Increasing the Efficiency of a Brass Manufacturing Plant," by P. W. Blair.

"Diamond N" Pipe and Boiler Coverings are dealt with in detail in a catalogue issued by the Norristown Magnesia and Asbestos Co., Norristown, Pa. The catalogue is printed in colors, with many illustrations and includes, in addition to detailed price lists, a double page illustration of the company's plant, which covers four acres. Size 4 x 8¾ in. Pp. 48.

Books on Electricity is the subject of a new catalogue which has been issued by the D. Van Nostrand Co., publishers and importers of scientific and practical books, 25 Park Place, New York. The catalogue is fully classified.

J-M Power Expert for December, 1912, published by the Cleveland branch of the H. W. Johns-Manville Co., contains an interesting description of the J-M pipe coverings and other insulating materials used in the Woolworth Building, New York, and in the Union Central Life Building, Cincinnati, O.

Marsh Quick Opening Double-Seat Valves, made by the Marsh Valve Co., Dunkirk, N. Y., are featured in a well-arranged catalogue showing the company's complete line. The Marsh valve contain two features that are especially emphasized. The first is that through the use of right and left hand threads, working against each other, the valve is operated with about one-third the number of turns required to open or close an ordinary valve. Through the use of low-pitch threads in advancing the disc holder of the end of the valve stem, the same grip or seating force is acquired as with low-pitch threads throughout in an ordinary valve. The other feature is that in opening the valve, the disc in the top of the upper disc holder is seated in the valve bonnet in the same manner and with the same force in which the disc is seated in the bottom of the valve in closing same, providing against any possibility of leakage of steam or water around valve stem or out through the stuffing box. Size 3¾ x 9 in. Pp. 24.

Ideal Heating Journal for November, 1912, published by the American Radiator Co., Chicago, has, as its leading article a description of the methods of testing radiators at its Institute of Thermal Research in Buffalo. Other articles contained in this issue are: "Character of Orifice Equally Important as Size in Vacuum Cleaner Construction," "Tank Regulators in Actual Practice," by E. S. White, and "Heating Economy vs. Power Waste."

Radiation for November, 1912, published by the United States Radiator Corporation, Detroit, Mich., has an illustrated description of the heating and ventilation of the Continental Motor Mfg. Co.'s concrete plant in Detroit. Other features of this number are "The Toy Stoves of Japan" (illustrated); and a further installment of Roufis St. John's "Heating Buildings with Steam," devoted principally to a discussion of risers, their location and support.

The Bulletin of the Institute of Operating Engineers for December, 1912, contains a detailed report of the institute's second annual meeting in New York, September 6-7, 1912.

Pressure Hot Water Heating by means of the "B" heat intensifier, made by the National Steam Specialty Co., 12-14 South Clinton St., Chicago, is the subject of a new catalogue from this company. The heat intensifier is a unique device intended to be placed in the pipe leading to the expansion tank and operates to automatically increase the water pressure and hence, the rapidity of circulation. The catalogue is taken up largely with a discussion of the advantages of pressure hot water heating systems over open-tank systems. Tables are included showing the amounts of radiation required with different water temperatures. The point is made that it is not necessary to maintain high pressures with this system but that when necessary the system quickly responds to such de-

mands. Other points are in connection with the use of smaller pipes, with no dead ends or reverse circulation. Size 6 x 9 ins. (standard). Pp. 12.

Extension of 1912 U. S. Standard Flange Schedule.

An extension of the U. S. Standard Schedule for standard weight and extra heavy flanged fittings and flanges to cover diameters from 30 in. to 100 in., is being undertaken by a committee of the American Society of Mechanical Engineers, according to its report made at the society's recent annual meeting. Arrangements are being made to have the cooperation in this work of the American Water Works Association and the New England Water Works Association, in addition to that of the National Asociation of Master Steam and Hot Water Fitters. The schedule for high pressure work will include all sizes up to 49 in. in diameter, while for pressures below 125 lbs., the sizes will run to 100 in. diameter.

Regarding the adoption of the present "U. S. Standard," it was stated by the chairman of the committee, H. G. Stott, that 89 manufacturers and 25 dealers are now prepared to furnish supplies made up according to this schedule.

A Statement.

Statement of the ownership, management, etc., of THE HEATING AND VENTILATING MAGAZINE, published monthly at New York, N. Y., required by the Act of August 24, 1912.

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Editor, A. S. Armagnac, 1123 Broadway, New York.

Business Manager, Gustave Petersen, 1123 Broadway, New York.

Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York.

Owners (if a corporation, give names and address of stockholders holding 1 per cent. or more of total amount of stock).

Gustave Petersen, 1123 Broadway, New York.

A. S. Armagnac, 1123 Broadway, New York.

Known, bondholders, mortgagees and other security holders, holding 1 per cent. or more of total amount of bonds, mortgages, or other securities: None.

(Signed) A. S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 1st day of October, 1912.

(Seal)

(Signed) A. L. SCANTLEBURY,

Notary Public No. 248, Kings County Certificate filed in New York County.

(My commission expires March 31, 1913.)

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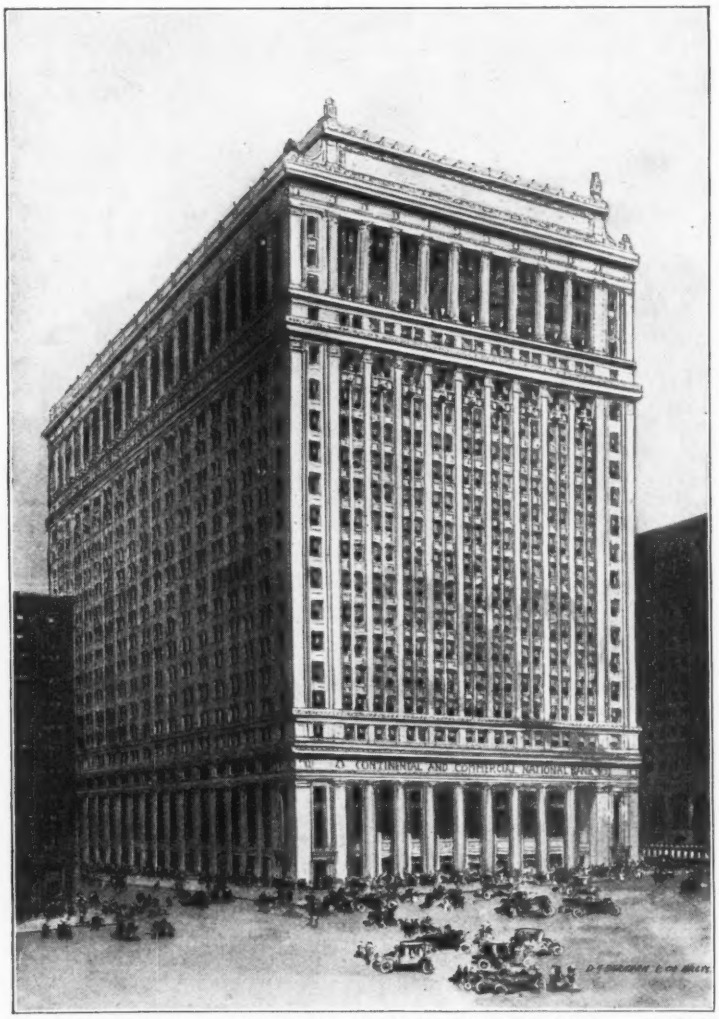

THE CONTINENTAL and COMMERCIAL NATIONAL BANK BUILDING CHICAGO
Hanley Casey Co., Heating and Ventilating Contractors, Chicago

D. H. BURNHAM & CO., Architects, Chicago, through their Board of Consulting Engineers and the Investigating Committee appointed by the Bank, adopted the MONASH NOISELESS SYSTEM of VACUUM HEATING for the CONTINENTAL & COMMERCIAL NATIONAL BANK BUILDING, which covers an entire city block, the largest building of its type under one roof in the world.

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